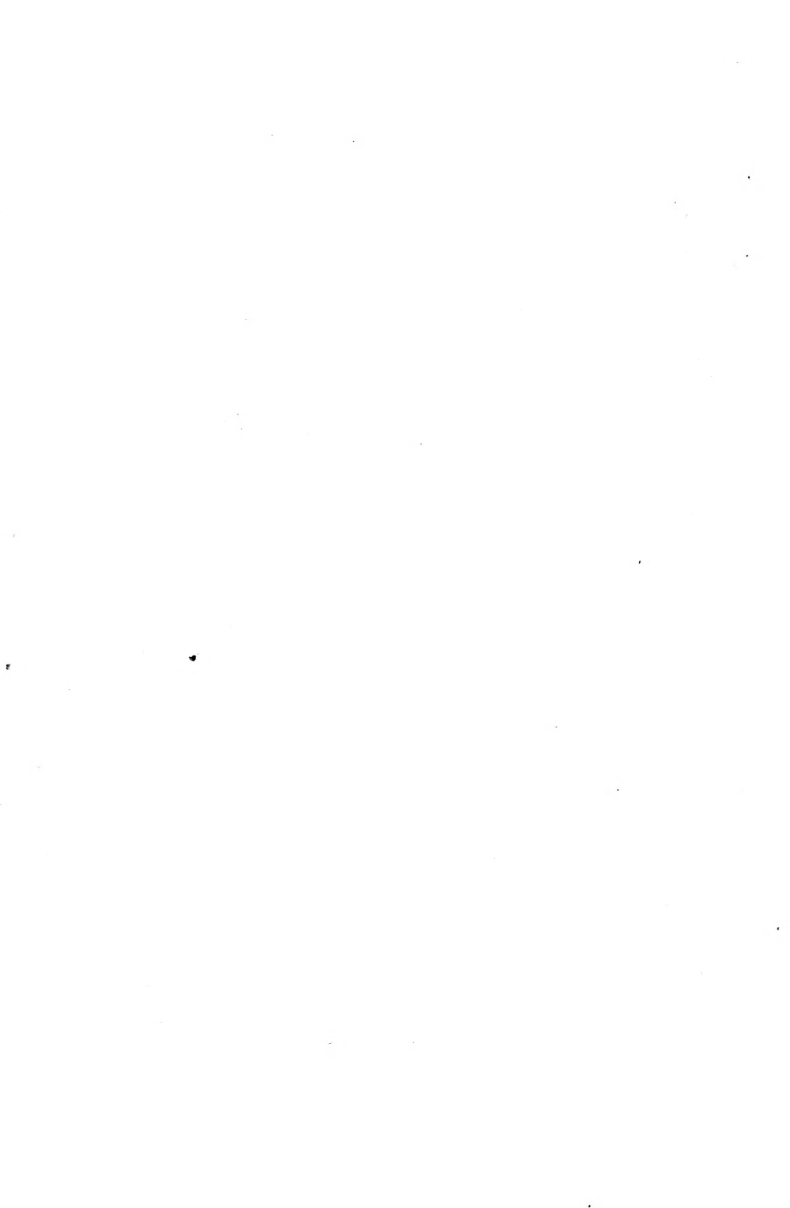


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A HANDBOOK
OF THE PRINCIPAL
SCIENTIFIC INSTITUTIONS
BOSTON AND VICINITY

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Prepared for the Fiftieth
Anniversary Meeting of the
American Association for the
Advancement of Science
by the Local Committee





A HANDBOOK
OF THE
Principal Scientific Institutions
OF
BOSTON AND VICINITY.

WITH A BRIEF ACCOUNT OF THE MORE IMPORTANT
PUBLIC WORKS, OF THE GEOLOGY AND
GEOGRAPHY, AND OF PLACES OF
HISTORICAL INTEREST.

Prepared for the
Fiftieth Anniversary Meeting of the
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
by the Local Committee.

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HARRY W. TYLER
Local Secretary

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PREFACE.

THE object of this pamphlet is to present to members of the American Association for the Advancement of Science and others a brief but comprehensive account of those institutions and public works which have particular interest for scientific visitors to Boston. Such an account finds no adequate place in the ordinary guide-book, and it is believed that in the present form it will serve a useful purpose. The Handbook is not intended to take the place of the various guide-books mentioned in the "Preliminary Announcement" of the committee, but rather to bring together such information as is not otherwise available in any one place.

In the selection of material and the assignment of space it has been the aim of the editorial committee to confine the Handbook for the most part to matters of distinctively scientific interest, and in the second place to allot relatively more space to those institutions with which the meetings of the American Association bring its members most in contact. The proportions of the different sections should not, therefore, be regarded as corresponding to the general scope or importance of the institutions under consideration. It is believed that the introduction of an account of the "places of historical interest" needs no apology. No attempt has been made to give an exhaustive treatment of any subject, but care has been taken to indicate how and where additional information may most readily be obtained. The sources of information have been in every case authoritative, and the editorial committee desires to express its most cordial thanks for the courteous coöperation of the officers of the various institutions and commissions represented.

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HARVARD UNIVERSITY.

The chief seat of Harvard University, at Cambridge, may be reached by means of any Cambridge electric car which runs to Harvard square. These cars will be found at Bowdoin square, at Park square, at the Park-street Subway, and at nearly all of the railroad stations. Cars for Harvard square pass the Rogers Building of the Massachusetts Institute of Technology.

For the use of the members of the Association the university has prepared a guide-book to Harvard University which will be distributed after the arrival of the members. The university, furthermore, issues pamphlets describing the various schools and departments of the university and the course of instruction of each of the divisions or departments under the Faculty of Art and Science.

In general, these pamphlets give lists of officers of instruction and government, and of students, and detailed statements concerning the following points: buildings, libraries, laboratories, museums, etc., requirements for admission, methods of instruction, text-books, courses of instruction, clinical advantages, examinations, requirements for degrees, prizes, scholarships, summer courses, fees, and expenses. Copies of any of these pamphlets may be obtained at the Publication Office of the university, 2 University Hall, Cambridge.

HARVARD COLLEGE, the oldest institution of learning in America, was founded in 1636 by a vote passed at an adjourned meeting (Oct. 28, old style) of the General Court of the Colony of Massachusetts Bay.

In 1638 John Harvard, a non-conforming clergyman of England, who had been in the colony about one year, died at Charlestown, leaving half of his whole property, and his entire library (about 300 volumes), to the institution. The value of this bequest was more than double

the entire sum originally voted by the Court, and it was resolved to open the college at once and to give it the name of Harvard. The first class was formed in the same year.

From this foundation has grown the present university, with an endowment of more than nine millions of dollars in quick capital, and more than five millions invested in buildings, libraries, laboratories, museums, observatories, gardens, collections, apparatus, etc.

At the present time the university includes the following departments where instruction is regularly given to students: Harvard College, the Lawrence Scientific School, the Graduate School, the Divinity School, the Law School, the Medical School, the Dental School, the Veterinary School, the Bussey Institution, the Summer School. Other departments are the Arnold Arboretum; the University Library, which includes the College Library and the special libraries of the schools named above and of departments, — in all numbering thirty-four, with more than five hundred thousand books; the Chemical Laboratory; the Jefferson Physical Laboratory; the special laboratories of the schools before enumerated; the Laboratory of the Peabody Museum of American Archæology and Ethnology; and the Laboratories of Zoölogy, Palæontology, Entomology, Geology, Physical Geography, Cryptogamic and Phanerogamic Botany, Mineralogy; the Museum of Comparative Zoölogy; the Botanical Museum; the Mineralogical Museum; the Peabody Museum; the Semitic Museum; the William Hayes Fogg Art Museum; the Warren Anatomical Museum at the Medical School; the museums of the various other schools; the Botanic Garden; the Gray Herbarium; the Astronomical Observatory; the Hemen-

way Gymnasium; the play-grounds; the boat-houses; and the buildings devoted to athletic sports.

The College Yard and its Surroundings.

In the College Yard, interesting from an historical point of view, are the older buildings — Massachusetts, Harvard, Hollis, Stoughton, and Holworthy Halls, Holden Chapel, Wadsworth House, and University Hall, in which are located the chief administrative offices of the university. Matthews, Weld, Thayer, and Grays Hall represent the dormitories constructed twenty or thirty years ago. Boylston Hall contains the Chemical Laboratory; Gore Hall the College Library; Sever Hall is devoted to recitation and lecture rooms; Appleton Chapel, where the religious exercises of the university are held, adjoins the William Hayes Fogg Art Museum. Phillips Brooks House is devoted to the uses of the various religious societies of the college.

Separated from the College Yard by Broadway is a small delta containing the Rogers Building, formerly the college gymnasium, now a laboratory of the Department of Engineering. In the larger delta beyond Cambridge street is Memorial Hall, erected in memory of the Harvard men who served in the Civil War. On marble tablets inserted in the walls of the transept are inscribed the names of the men who fell in the war. Sanders Theatre, at the eastern side of the transept, is used for lectures, concerts, and official ceremonies of the university; the Dining Hall, where during term-time more than eleven hundred students board, is at the western side of the transept. On the walls of this hall are placed portraits and busts of the

founders of the university, its benefactors, and its illustrious graduates. Most of the memorial windows are the gifts of classes. In the delta, west of the Dining Hall, is a statue of John Harvard. In Oxford street, which leads from Kirkland street on the north of Memorial Hall, are Perkins and Conant Halls. These, with Walter Hastings Hall on Holmes Field, entrance to which is gained from Massachusetts avenue, are types of the modern dormitory. The Hemenway Gymnasium, the building of the Lawrence Scientific School, the Jefferson Physical Laboratory, and the Law School are in Holmes Field, near the College Yard. In Divinity avenue, not far from Memorial Hall, are the Divinity School, the Peabody Museum of American Archaeology and Ethnology, and the University Museum, entrance to which may also be gained from Oxford street. The Observatory, the Botanic Garden, and the Herbarium are in Garden street, ten minutes' walk from the College Yard. Mount Auburn cars, *via* Huron avenue, which may be taken in Boston or at Harvard square, go near these departments. The Athletic grounds, the Soldiers' Field, the Locker Building, and the Weld Boat-house are by the river, ten minutes' walk from Harvard square along Boylston street.

Departments of the University.

In matters of administration three of the departments of the university are closely united. HARVARD COLLEGE, the LAWRENCE SCIENTIFIC SCHOOL, and the GRADUATE SCHOOL are under the charge of the Faculty of Arts and Sciences; and the students of these three departments do much of their work together, using recitation-rooms, laboratories, museums, libraries, etc., in common.

To the students under its charge this Faculty offers more than five hundred courses of instruction.

The LAWRENCE SCIENTIFIC SCHOOL offers eleven four-year courses of study: civil and topographical engineering, electrical engineering, mechanical engineering, mining and metallurgy, architecture, chemistry, geology, biology, anatomy, physiology and hygiene, science for teachers, general science.

The LAW SCHOOL and the DIVINITY SCHOOL, for the purposes of this book, are here only mentioned in passing.

The MEDICAL SCHOOL occupies a building in Boylston street, Boston, adjoining the Boston Public Library. The building contains the usual lecture and recitation rooms; the laboratories of anatomy, physiology, histology, chemistry, bacteriology, and pathological anatomy; the library, which is distributed among the several departments; and the Warren Anatomical Museum.

The DENTAL SCHOOL, established in 1867, occupies a building in North Grove street, Boston, formerly used by the Medical School. In addition to the usual lecture and recitation rooms and laboratories the building contains a library, and a museum of over 3,000 specimens.

The SCHOOL OF VETERINARY MEDICINE, instituted in the year 1882-83, is situated at and near the corner of Village and Lucas streets, Boston. It occupies two brick buildings: the Lucas street building, which contains rooms for lectures and dissections, the library, and the museum, and the Village street hospital, for the treatment and observation of sick animals. In a third building a free clinic is maintained in connection with the school.

The BUSSEY INSTITUTION, a School of Agriculture

and Horticulture, established in execution of trusts created by the will of Benjamin Bussey, was opened in 1871-72. It gives systematic instruction in agriculture, in useful and ornamental gardening, and in chemistry and natural history as applied to these arts. The institution is situated at the outer edge of Jamaica Plain, about five miles southwest of the centre of Boston, and close to the Forest Hills Station on the Providence Division of the N.Y., N.H. & H. R.R. It is, in general, meant for young men who intend to become practical farmers, gardeners, florists, or landscape gardeners; as well as for those who will be called upon to manage large estates, or who wish to qualify themselves to be overseers or superintendents of farms, country seats, parks, towns, highways, or public institutions. It may serve also in special cases as a school for the systematic training of young men fond of country life or interested in natural history.

The ARNOLD ARBORETUM was founded in 1872, by the trustees under the will of James Arnold, of New Bedford, for the purpose of scientific research and experiment in agriculture, forestry, and dendrology, and as a museum of trees and shrubs suited to the climate of Massachusetts. The arboretum occupies a portion of the Bussey Farm in West Roxbury, two hundred and twenty acres in extent, and under a special arrangement with the city of Boston is open to the public every day in the year from sunrise to sunset. The living collections are supplemented by an herbarium, a museum, and a library.

The UNIVERSITY LIBRARY. — The College Library, in Gore Hall, situated in the College Yard, Cambridge, is for the use of the whole university. In addition to

this library the University Library embraces the libraries of the several departments of the university, which are classed as departmental libraries, and the libraries maintained in the various branches of study pursued under the direction of the Faculty of Arts and Sciences, which are classed as laboratory and class-room libraries. The several libraries now contain about the following numbers of bound volumes :

Gore Hall	:	355,600
Lawrence Scientific School (Engineering Li- brary)		5,000
Bussey Institution (Jamaica Plain)		3,600
Phillips Library (Observatory)		8,600
Botanic Garden (Herbarium Library) . . .		7,300
Law School		40,900
Divinity School		27,500
Medical School (Boston)		2,200
Museum of Comparative Zoölogy		32,000
Peabody Museum		1,800
Arnold Arboretum		5,800
Fogg Museum		¹ 100
Seven laboratory and sixteen class-room libra- ries		15,200
		<hr/> 505,600

The collection of pamphlets and maps in the College Library is very large, and is estimated to be equal in number to the collection of bound volumes. The departmental libraries have also considerable numbers of pamphlet monographs on subjects connected with their

¹ In addition a large collection of photographs of paintings, sculpture, and architecture, and many casts.

specialties, and these are not included in the count of volumes. The College Library has also a collection of coins.

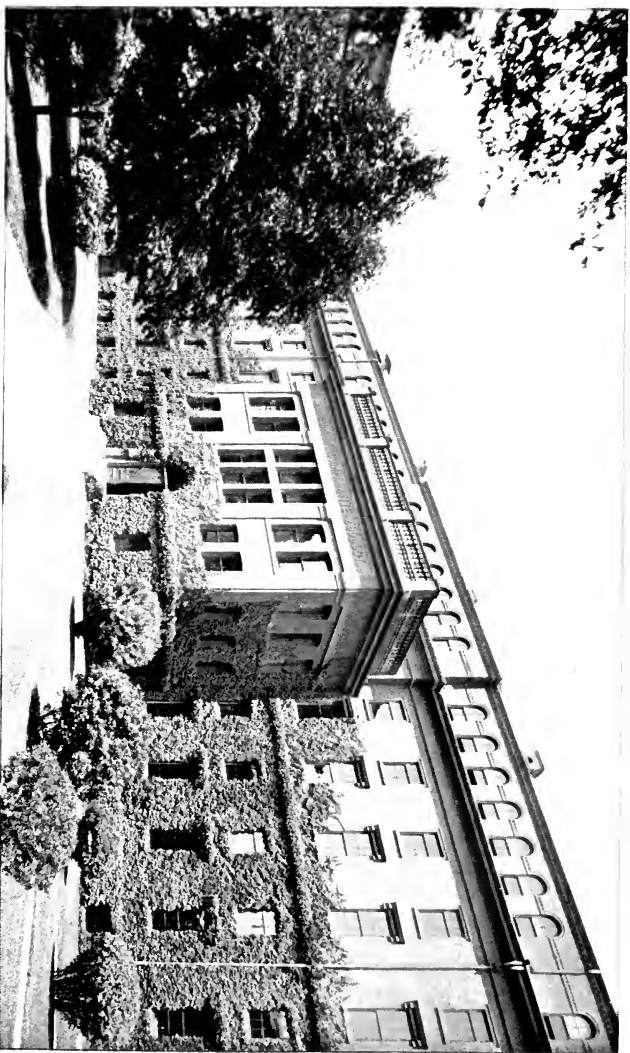
The catalogue of the Gore Hall collection, including pamphlets, is on cards, accessible to the public, and consists of two parts, the one arranged by authors, the other by subjects.

Museums and Laboratories.

The UNIVERSITY MUSEUM, located in Cambridge, comprehends the Museum of Comparative Zoölogy, the Botanical Museum, the Mineralogical Museum, the Natural History Laboratories, and the Peabody Museum of American Archæology and Ethnology. The Semitic Museum is for the present placed in the building of the Peabody Museum.

The MUSEUM OF COMPARATIVE ZOÖLOGY. — This museum was founded in 1859 by private subscription and the assistance of the State of Massachusetts. In 1876 the property in the hands of the Trustees was transferred to the President and Fellows of Harvard College.

The exhibition-rooms open to the public are the Synoptic Room; the rooms containing the systematic collections of mammals, birds, reptiles, fishes, mollusks, crustacea and insects, radiates, sponges, and protozoa; also the rooms devoted to the faunal collections of Europe, of North and South America, the Indo-Asiatic, the African, the Australian Realms, and the Atlantic and Pacific Rooms; and the rooms devoted to the Quaternary, Tertiary, and Mesozoic fossils. The collections, so far as arranged, are open to visitors every week-day from 9 A.M. till 5 P.M., and on Sun-



HARVARD UNIVERSITY — UNIVERSITY MUSEUM.

day from 1 P.M. till 5 P.M. Entrance on the south side of the north wing, from Divinity avenue.

The publications of the museum consist of an annual Report (1861-1897), of an octavo Bulletin (vols. i.-xxx.), and of Memoirs in quarto (vols. i.-xxii.). The Bulletin and Memoirs are devoted to the publication of original work by the professors and the assistants of the museum, of investigations carried on by students and others in the different laboratories of natural history, and of work by specialists based upon the museum collections.

The library of the museum is on the second floor of the northwest corner of the museum. It contains over 23,000 volumes, exclusive of 2,900 volumes of pamphlets and of the Whitney Library, containing about 5,000 volumes and nearly 1,500 pamphlets, making the total number of volumes 31,200, and about 1,800 pamphlets not yet arranged. The reading-room is open from 9 to 1 and from 2 to 5.

The museum includes the Laboratories of Zoölogy, Palæontology, Entomology, Geology, and Physical Geography.

THE BOTANICAL MUSEUM.—The collections of this museum at present accessible to the public are on the third floor of the central section of the University Museum. They are designed to illustrate the principal systematic, biological, and economic relations of plants. The large and increasing **WARE COLLECTION** of glass models of flowers, prepared by the artists Leopold and Rudolph Blaschka of Germany, occupies the large exhibition-room. Contiguous rooms contain collections of cryptogams and economic products.

The Laboratories of Cryptogamic and Phanerogamic Botany are on the fifth and the second floors, respectively.

THE MINERALOGICAL MUSEUM. — The mineralogical section of the University Museum, built in 1890-91 with a fund of about \$50,000, raised wholly by subscription, forms the southern end of the University Museum, so far as at present completed. Entrance is by the south door in Oxford street.

The exhibition-room and gallery occupy the third and fourth floors, and are open to the public on Wednesday and Sunday afternoons from 1 to 5, and Saturday from 9 to 5.

The Mineralogical Laboratories occupy a part of the second floor, the first floor, and the basement.

The main mineralogical collections of the university are deposited here; they contain on the ground floor and gallery the large systematic collection, with special features and collections, such as the J. Lawrence Smith Collection of Meteorites, the William Sturgis Bigelow Agates, the Hamlin Collection of Tourmalines, and many unique specimens presented by James A. Garland and others.

THE PEABODY MUSEUM OF AMERICAN ARCHÆOLOGY AND ETHNOLOGY. — The entrance to the museum is on Divinity avenue. The museum is open to the public from 9 A.M. till 5 P.M. throughout the year, Sundays and holidays excepted. The arrangement of the collections is intended to facilitate research in general anthropology with special reference to American and comparative archæology and ethnology. The Mary Hemenway Collection of Archæology and Ethnology of the South-western Tribes is arranged in the second gallery and in the large hall on the floor above. The collection obtained from the ancient ruins of Copan, by the special expeditions of the museum, is arranged in the large

hall on the third floor. The crowded condition of the hall will not permit its being opened to the public, but visitors will be admitted by applying at the office. The Anthropological Library contains 1,838 volumes and 2,479 pamphlets. The publications of the museum consist of Annual Reports, Special Papers, and Memoirs.

THE SEMITIC MUSEUM. — This museum was founded in 1889 by Jacob H. Schiff, and was opened on May 13, 1891. It occupies temporarily a gallery in the new section of the Peabody Museum building, and is open to students and the public daily, except Sundays and holidays, from 9 A.M. till 5 P.M. The object of the museum is to gather such materials as shall illustrate the Semitic instruction given in the university, provide students and other specialists with the means of original research, and give to the general visitor as complete a view as possible of the products of Semitic art and archæology.

The collection contains manuscripts, coins, photographs, Babylonian-Assyrian seals, cuneiform tablets of clay and stone, Phœnician glassware, and a large number of casts of the finest of the Semitic monuments in the European museums.

THE WILLIAM HAYES FOGG ART MUSEUM. — This museum, situated in the College Yard, facing Broadway, was founded by Mrs. Elizabeth Fogg, of New York, in memory of her husband, whose name it bears. The building is of two stories, with a large lecture-room, having a seating capacity of about five hundred, attached. On the ground floor is a large hall for casts, with five smaller rooms for casts and other objects. The upper floor has a large gallery and four smaller rooms for the exhibition of works of art and for admin-

istration. The collections thus far consist of casts from important works in sculpture of the ancient, mediæval, and Renaissance epochs, a classified collection of electrotypes from Greek and Roman coins, a small series of Greek vases, and a large and growing collection of photographs of works of art of all epochs and countries, including architecture, sculpture, and painting. These photographs are conveniently classified and catalogued, and are at all times accessible to members of the university and other visitors.

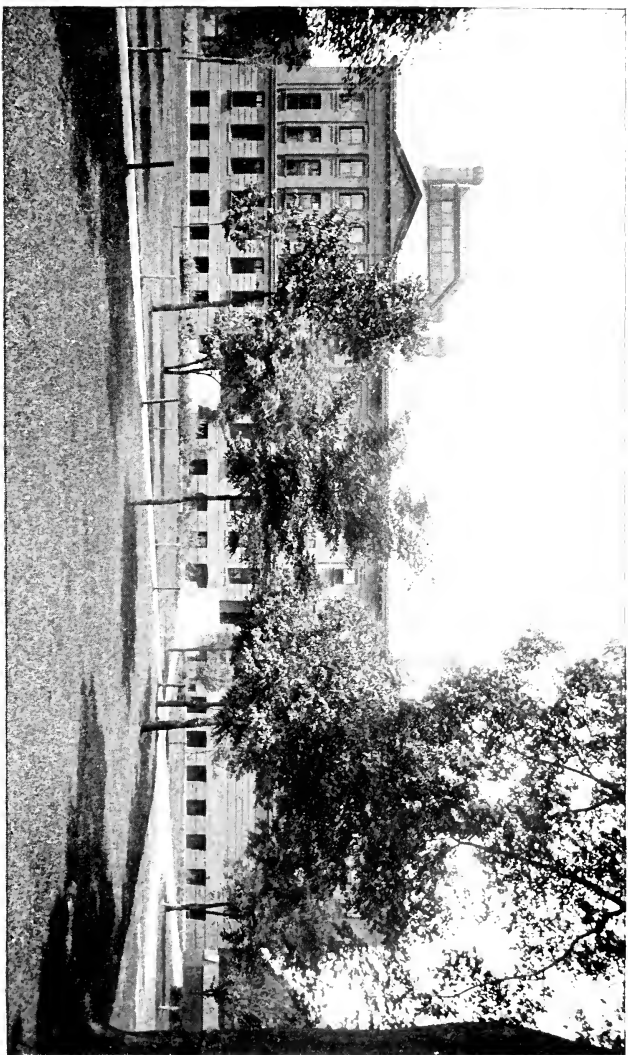
In the larger east room on the upper floor is deposited the Gray Collection of Engravings. This important and very valuable collection was bequeathed to Harvard College, with provision for its increase and maintenance, by the Hon. Francis Calley Gray, LL.D., of the Class of 1809.

The museum is open daily from 9 until 5 o'clock, and from 7 until 9 in the evening. On Sundays it is open from 1 until 5 in the afternoon.

In addition to the museums above named the university possesses museums at the MEDICAL and DENTAL SCHOOLS and the SCHOOL OF VETERINARY MEDICINE. These are mentioned under the description of the several schools.

The CHEMICAL LABORATORY occupies the whole of Boylston Hall, erected in 1857 with a fund bequeathed by the late Ward Nicholas Boylston, which is situated in the College Yard. Besides several private laboratories and preparation-rooms the building contains seven large laboratories for students.

The JEFFERSON PHYSICAL LABORATORY was the gift of Thomas Jefferson Coolidge, of Boston, who, in 1881, gave \$115,000 to the college for a physical laboratory,



HARVARD UNIVERSITY. — JEFFERSON PHYSICAL LABORATORY.

on condition that \$75,000 should be raised by subscription and the income appropriated to its support. All the instruction in physics, by recitations, lectures, and experimental work, to students of Harvard College, of the Lawrence Scientific School, and of the Graduate School, is given in this building, which accommodates the various physical cabinets. The building is on Holmes Field, Cambridge.

THE BOTANIC GARDEN.

The Botanic Garden, founded in 1807, occupies about seven acres of land at the corner of Linnaean and Garden streets, Cambridge. More than five thousand species of flowering plants are cultivated for educational and scientific purposes.

The range of greenhouses comprises eight divisions assigned respectively to: (1) Succulents. (2) Australian plants. (3) Mexican plants and Ferns. (4) Palms and their allies. (5) Tropical orchids, aroids, etc. (6) Economic plants of hot climates. (7) Native plants forced into early blooming. (8) Plants grown for experimental use.

The space at the northwestern part of the garden is devoted to an exhibition of a large number of our North American species, with special reference to their morphology. The ground below the terrace is filled with illustrations of the orders and principal genera of the plants of the United States, together with species from the Old World for comparison.

The grounds and greenhouses are open to the public daily, from sunrise to sunset.

THE GRAY HERBARIUM.

The Gray Herbarium occupies a building in the Botanic Garden. The collection, presented to Harvard University in 1864 by the late Professor Asa Gray, now contains about two hundred and fifty thousand sheets of specimens, and is the result of more than sixty years of continuous growth. It embraces all orders of flowering plants, vascular cryptogams, and bryophytes; the fungi, lichens, and algæ have now been transferred to the Cryptogamic Herbarium in the Botanical Division of the University Museum. The Gray Herbarium is rich in type specimens of species and varieties, in standard and rare phænogamic *exsiccata*, and in the possession of the greater part of the specimens which have been critically studied in the preparation of the "Synoptical Flora of North America."

The bryophytes, chiefly represented by the extensive and valuable collections of Sullivant, James, and Taylor, are not accessible for general consultation. Other parts of the herbarium may be consulted, under supervision of the staff, by advanced students and other properly qualified persons. Visiting specialists receive such facilities for work as can be given without interrupting the regular duties of the staff.

The library of the herbarium, now including more than twelve thousand carefully selected volumes and pamphlets, is open for consultation to all persons interested in botany.

The scientific publications of the herbarium at present embrace the following classes of work: I. The continuation of the "Synoptical Flora of North America." II. The issue from time to time of "Contributions



HARVARD UNIVERSITY. — ASTRONOMICAL OBSERVATORY.

from the Gray Herbarium of Harvard University," a series of technical papers devoted chiefly to the characterization of new species and monographing of genera. III. The preparation of lesser articles, both technical and popular, published in various scientific journals.

THE ASTRONOMICAL OBSERVATORY.

The Astronomical Observatory, between Garden street and Concord avenue, in Cambridge, was established by means of a subscription initiated in 1843. The Sears Tower was completed in 1846, and the great refractor was received at the close of the same year. In 1848 Edward Bromfield Phillips, of the Class of 1845, bequeathed to the university the sum of one hundred thousand dollars for the benefit of the observatory. In 1885 Robert Treat Paine, of the Class of 1822, bequeathed his entire fortune, amounting to more than a quarter of a million of dollars, to the university, for the observatory.

The observatory was founded for the purpose of scientific research in all departments of astronomy. To fulfil this purpose it has been equipped with instruments of the first class and with a library of more than twenty thousand works (of which about half are pamphlets), principally relating to astronomical subjects. It has likewise been provided with funds for the maintenance and increase of its equipment and library, and for the payment of its current expenses, special provision having also been made for the publication of its observations.

One of the principal departments of the observatory is the Henry Draper Memorial, maintained by Mrs. Draper, to permit the study on a large scale of the spectra and other physical properties of the fixed stars.

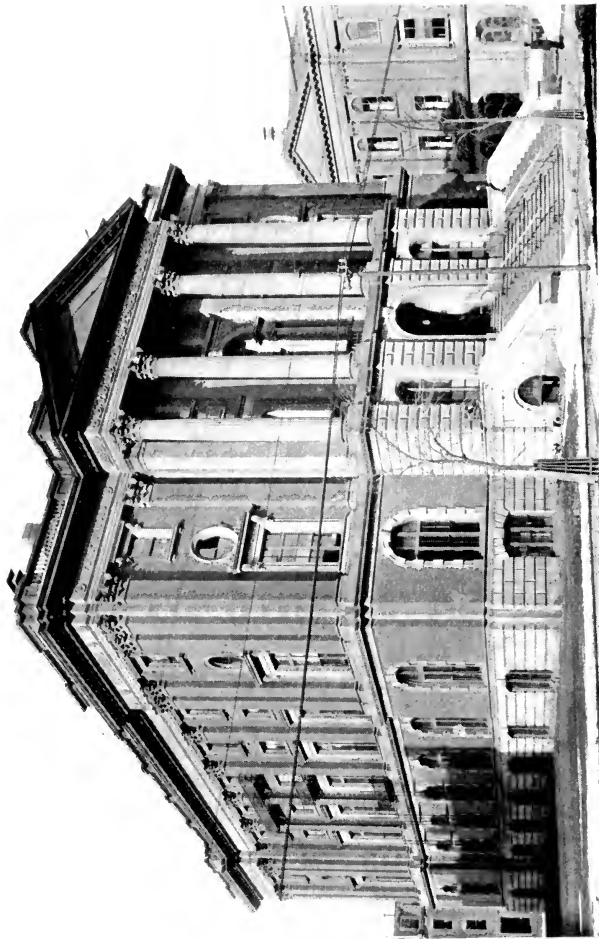
The Boyden Fund furnishes the means of establishing an observing station, on a site 8,000 feet high, near Arequipa, Peru. In addition a series of meteorological stations has recently been established, crossing the Andes at the elevations of 100, 4,150, 8,060, 13,300, 15,600, 19,200, 11,000, and 3,000 feet.

In coöperation with the Blue Hill Meteorological Observatory, under the direction of Mr. Rotch, meteorological observations are maintained, and the results published in the *Annals of the observatory*.

The observatory is now provided with a photographic telescope of greater size than that of any similar instrument hitherto constructed. This telescope is the gift of Miss C. W. Bruce, of New York. Its object-glass consists of four lenses, each 24 inches in aperture. The work for which it is specially designed is the production of stellar charts and photographs of stellar spectra. This instrument is now mounted at Arequipa, and is in use every clear evening.

By the mutual consent of astronomers the Kiel and Harvard observatories have been selected as the centres for the prompt announcement of astronomical discoveries.

Forty assistants take part in the work of the observatory. The results obtained are published in a series of *Annals*, and now fill thirty-six quarto volumes. The preparation of these volumes occupies a large part of the force at the observatory in Cambridge. Besides this labor a large amount of observation is done there, several instruments being kept in constant use. The largest of these are the fifteen-inch and six-inch equatorial telescopes, the eight-inch transit circle, the eleven-inch Draper photographic telescope, the eight-inch photographic telescope, and the meridian photometer.



MASSACHUSETTS INSTITUTE OF TECHNOLOGY. — ROGERS' BUILDING.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Administrative offices, Departments of Mining, English, Mathematics, Drawing, History, and Economics, 491 Boylston street; Departments of Physics and Chemistry, 525 Boylston street; Department of Civil and Mechanical Engineering, Architecture, Biology, Geology, and Naval Architecture, Trinity place (near Copley square); Workshops, Garrison street (near Huntington avenue).

Catalogues and other publications may be obtained at the Secretary's office, Rogers Building.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY was opened to students in the year 1865, after four years spent in preparation by Prof. William Barton Rogers, its first President, and his co-workers, men of science and of business. Its connection with the State has been marked by a generous grant of land, in what is now a central position in Boston. The State has also aided the institute by a gift of \$100,000, by a fund of like amount for scholarships, and by an allotment of one-third of the national grants to the State under the Acts of 1862 and 1890; also, since 1895, by a gift of \$25,000 per annum. The larger part of its endowment is, however, derived from gifts by private individuals.

The institute was founded by President Rogers, at a time when the few scientific schools of the country were chiefly occupied with teaching civil and mining engineering and chemistry, and were often annexed in a more or less accredited way to colleges. The new school of applied science was intended by its founders to have an

independent existence, and to offer a curriculum of a sufficiently wide scope to constitute a liberal education. This plan, begun under President Rogers, was continued with singular energy and faithfulness by his successors, Presidents John D. Runkle and Francis A. Walker, and the school now gives the degree of Bachelor of Science in twelve courses of professional studies and one course of general studies, each with a prescribed curriculum.

Young men about the average age of nineteen are taken with the preparation afforded by good secondary schools, and are fitted, by a four years' course, to enter upon the professional work of civil, mechanical, electrical, naval, sanitary, chemical, or mining engineers, metallurgists, geologists, physicists, chemists, biologists, or architects. These courses have sprung into existence as the need for them has become apparent, and the readiness with which any branch of technical education leads to employment appears to determine, in large measure, the number of students taking a given course. Other scientific schools have since established a similarly complete curriculum, and particularly in Germany and in England educational effort has turned in this direction with large expenditures and an abundant equipment of industrial museums; but nowhere have the means for experiments on an industrial scale in certain branches of engineering been developed so completely as in Boston.

The degree in the above-named courses was conferred this year upon 198 students following a prescribed curriculum, while many others took elective studies not leading to a degree. The total number of students during the past year was 1,198. Graduate courses,

summer schools, and free evening courses, maintained by the Lowell Institute, supplement the work already mentioned.

Mathematics, drawing, chemistry, and physics form the basis of the technical studies of the school and are a necessary preparation for them, while considerable time is also expended upon modern languages, English literature, history, and political economy.

The exigencies of a situation in a large city, and the absorption of funds for every-day work, have precluded the possibility of a display of scientific collections, of buildings or grounds, but the institute offers for the inspection of members of the American Association the evidences, in its laboratories, drawing-rooms, and work-shops, of some of the features of its practical teaching. (Some of these laboratories are, however, undergoing transformations in consequence of the erection of a new building to be used by the architectural, biological, and engineering departments.)

Laboratories.

The chief and dominating feature of the Institute of Technology, from the material point of view, consists of its numerous and well-equipped laboratories. The buildings of the institute in addition to all drawing, recitation, and lecture rooms, and libraries, comprise eight laboratories or groups of laboratories :

- I. The Kidder Chemical Laboratories.
- II. The Rogers Laboratory of Physics.
- III. The John Cummings Laboratory of Mining, Engineering, and Metallurgy.
- IV. The Engineering Laboratories, including the Laboratory of Applied Mechanics, the Steam Laboratory, and the Hydraulic Laboratory.

- V. The Biological Laboratories.
- VI. The Architectural Laboratory.
- VII. The Geological Laboratory.
- VIII. The Mechanical Laboratories or Workshops.

I. KIDDER CHEMICAL LABORATORIES. — All regular students of the institute receive their first laboratory training in the Laboratory of General Chemistry. The time devoted to this work is sixty hours in the first term of the first year. In the second term most students take qualitative analysis to the same extent, while those in the chemical course devote one hundred and eighty hours to the subject.

The Laboratories of Analytical Chemistry are devoted not only to the needs of students in the chemical courses, but largely also to the needs of those coming from the departments of mining engineering, sanitary engineering, biology, physics, and geology.

Besides these laboratories for large classes there are a considerable number of smaller special laboratories, used mainly by students in chemistry, which provide for a wide range of technical and scientific work, including sanitary, organic, and industrial chemistry and textile coloring.

The Chemical Laboratories occupy the upper floors of the Walker Building. They are 18 in number, with accommodations for more than 600 students.

More detailed information may be found in the special circular on the Department of Chemistry.

II. ROGERS LABORATORY OF PHYSICS. — In this laboratory is given instruction in pure and applied physics, including technical electricity. The laboratory instruction is accompanied by lectures and other class-work.

The principal divisions of the Rogers Laboratory are as follows: the Laboratory of General Physics, designed for instruction in the principles and methods of physical measurement; the Laboratory of Electrical Measurements, for the study of the various methods of refined scientific and technical electrical measurement and testing; the Laboratory of Heat Measurements, for the study of advanced problems in thermometry, pyrometry, and calorimetry; the Laboratory of Physical Chemistry, devoted to modern thermo- and electro-chemistry; the Laboratory of Acoustics, designed for the study of acoustic and telephonic phenomena; and the Laboratory of Electrical Engineering, devoted to the study and testing of dynamo-electric machinery and other apparatus of like character.

Prior to entering upon laboratory work in physics the students have laboratory practice in chemistry and an extended course of lectures and recitations in general physics, as well as a considerable amount of advanced mathematics.

Besides the instruction in already known facts, principles, and methods of physics, facilities are furnished for physical research, particularly in electricity, heat, sound, and physical chemistry, and the results of many such investigations have been published from the laboratory.

The physical laboratories occupy the basement and first floor, with a portion of the second floor of the Walker Building, sixteen rooms in all. The number of students working in them last year was about 330.

Detailed information in regard to the laboratories and their equipment will be found in the special circular on the courses in Physics and Electrical Engineering.

III. JOHN CUMMINGS LABORATORY OF MINING ENGINEERING AND METALLURGY. — Unlike the laboratories of physics and chemistry, this laboratory is designed mainly to meet the specific professional needs of students in a particular department, who have already received general training in chemistry and physics. Instruction is given in the mechanical preparation of ores by crushing and concentrating machinery, and in assaying and smelting. At the same time students receive instruction in the proper chemical methods in the Kidder Laboratories, as before mentioned. The equipment of the laboratory has been designed on such a scale that the various processes can be applied to quantities of material large enough to illustrate methods, but not large enough to be burdensome. This gives the student preparation of direct value for his future professional needs.

A special circular gives full details in regard to the work of this department.

IV. ENGINEERING LABORATORIES. — Work in the Engineering Laboratories is taken in the third or fourth years, or both, in the courses in civil, mechanical, electrical, chemical, and sanitary engineering, and naval architecture. The number of students for the past term was about 270. The work consists mainly of tests of the strength of materials in the Laboratory of Applied Mechanics; tests upon steam engines in the Steam Laboratory; and measurements of the flow and pressure of water under various conditions in the Hydraulic Laboratory. The work is conducted by small parties of students each under the direction of an instructor, and is so organized that the results obtained are to a great extent of direct value in the deter-

mination of engineering constants for use in the profession.

Tests of the strength of materials are made upon specimens of large size ; for example, by an Emery testing machine of 300,000 pounds' capacity, capable of containing a compression specimen of 18 feet or a tension specimen of 12 feet in length.

In addition to the work done in the laboratories under the prescribed course of instruction complete tests of large power plants are frequently carried on by the fourth-year students under the direction of the professor in immediate charge of the laboratory.

The laboratories will occupy next year a total floor-space of about 21,380 square feet.

A special circular with plans and description of the Engineering Laboratories is now in press.

VIII. MECHANICAL LABORATORIES OR WORKSHOPS.
—The workshops of the Institute of Technology were founded in 1876. In 1883 a new and extensive series of shops were constructed, covering about 24,000 square feet of ground. They contain an ample equipment for instruction in carpentry and wood-turning, pattern-making, foundry work, metal-turning, chipping and filing, forging, and machine-tool work. The shops are laboratories in mechanics; and the use of them is intended to be as scholarly as the use made of the other laboratories of the institute.

A description of the collections and rooms of the Architectural, Biological, and Geological Departments is omitted because they are in process of removal to a new building. Special circulars may be had on application.

Libraries.

The proximity of the Boston Public Library has relieved the institute of the necessity of accumulating large collections of books for general purposes. Books are regarded as apparatus of instruction, and the collections are, therefore, distributed in a number of libraries, ten in all, in direct connection with the several departments. The total number of books is 47,000.

The General Library is to be situated in Room 16 of the Rogers Building, and comprises works on educational subjects, general books of reference, and the collections of the Departments of English Literature and Modern Languages. In addition to the card catalogues in the separate libraries there is a general card catalogue in this room which shows where every book belonging to the institute may be found.

The nine departmental libraries include the Engineering Library, for the Departments of Civil, Sanitary, and Mechanical Engineering and Naval Architecture, with about 9,000 volumes; the William Ripley Nichols Chemical Library with 7,400 volumes; the Physical Library with 6,000 volumes; the Architectural Library with 2,200 volumes and over 6,000 photographs; the Library of History and Economics with 9,000 volumes; the Mining Library with 2,000 volumes; the Biological Library with 2,100 volumes; the Geological Library with 1,800 volumes; and the Mathematical Library with 560 volumes. About 850 serial publications are received at the institute, forming one of the largest collections of scientific journals, magazines, reviews, and reports to be found anywhere in the world.

SOCIETY OF ARTS.

The society was an integral part of the original plan of the institute. It aims to awaken and maintain an interest in the practical applications of the sciences, by holding semi-monthly meetings, at which reports of inventions, discoveries, and matters of scientific and technical interest are presented.

PUBLICATIONS OF THE INSTITUTE.

Besides the various departmental circulars mentioned above, and the Annual Catalogue and President's Report, the Institute publishes the "Technology Quarterly," containing the proceedings of the Society of Arts and papers representing the results of original investigation carried on at the institute.

TECHNOLOGY CLUB.

The Technology Club aims to promote the common social interests of past and present officers and students of the institute. By the courtesy of the club its house, 71 Newbury street, close by the Rogers Building, is open to members of the American Association during the meeting.

BOSTON UNIVERSITY.

The central offices of the university are at 12 Somerset street, where copies of the Year Book and other publications may be obtained. The hall of the Law Department is open in the forenoon daily, during the summer, and access to other departments may be obtained on application at the Treasurer's office.

THE university received its charter in the year 1869. Twenty-five years later it had over 1,000 students. The growth of the last three years is shown by the following registrations: 1,270, 1,327, 1,454. The history of the university has been presented by C. K. Dillaway in Winsor's "Memorial History of Boston," and by Dr. George Gary Bush in the "History of Higher Education in Massachusetts," published by the Bureau of Education, Washington, D.C., pages 341-363.

The College of Liberal Arts is domiciled in Sleeper Hall, at 12 Somerset street. Attendance the past year was 455. The college maintains no independent laboratories or staff of instructors in the natural sciences, the classes receiving their scientific instruction in the laboratories of the Massachusetts Institute of Technology and of the Boston Society of Natural History.

The School of Theology, formerly the Boston Theological Seminary, was founded in 1839. Attendance the past year, 170. Its hall is a little west of the State House, at numbers 70 and 72 Mount Vernon street.

The School of Law is on Ashburton place, midway between the State House and the new Court House.

This hall is the latest and finest belonging to the university, having cost, with the land, a quarter of a million dollars. Students, the past year, numbered 433.

The School of Medicine is on East Concord street, opposite the City Hospital and adjacent to the Massachusetts Homœopathic Hospital. It has 52 teachers and 195 students.

The Graduate School of Arts and Sciences in Sleeper Hall has 100 candidates for advanced degrees. During the past year the students in the university already possessing literary or professional degrees came from 104 American and foreign colleges, universities, and professional schools. The list of these may be seen in the University Year Book.

The assets of the university above liabilities at the close of the last fiscal year were \$1,614,053.37. The receipts of the year were \$237,967.39.

The President of the university is Rev. William F. Warren, LL.D.; the President of the Corporation is the Hon. William Claflin, LL.D., ex-Governor of the Commonwealth.

TUFTS COLLEGE.

The college is situated on the commanding eminence known as College Hill, on the boundary line between Medford and Somerville. It is about four miles from Boston, on the Southern Division of the Boston & Maine Railroad; twenty-four trains daily each way stop at its station, — Tufts College, — and furnish easy means of communication with Boston.

TUFTS COLLEGE was founded in 1854, and graduated its first class in 1857. Under its charter it is empowered to confer such degrees as are usually conferred by colleges in New England. Its total endowment is estimated at \$1,800,000.

The present organization of the college comprises the College of Letters, the Divinity School, and the Medical School. The College of Letters offers undergraduate courses leading to the degrees of Bachelor of Arts, Bachelor of Philosophy, and Bachelor of Science. The ground of promotion and graduation is the intellectual attainment of the individual student, and not a fixed requirement of a certain number of years of study; but four years are regularly required to complete work for a degree, the completion of the course in three years being possible only in exceptional cases and for especially high standing. The courses in arts and philosophy offer a wide range of choice of studies, while those in science consist chiefly of prescribed work on special lines.

The plan of study in the former cases is at once liberal, controlled, and elastic. The students have large



TUFTS COLLEGE. — CAMPUS FROM THE WEST.

liberty in choosing their work, but they are brought into personal advisory relations with the heads of the departments in which they elect to do special work, and under their directing influence a reasonable amount of guided specialization is provided for.

The degree of Bachelor of Science is offered for the satisfactory completion of four-year courses in general science, chemistry, biology, medical preparatory studies, civil, electrical, and mechanical engineering. The general science course is designed to prepare for science-teaching in schools; the chemistry course to prepare teachers and practical chemists; the biology course to secure in biology results similar to those sought in the special course in chemistry; and the medical preparatory course for those intending to study medicine. The three engineering courses of Tufts have long held a high reputation for the practical quality of their work and the thoroughness with which they prepare men for actual service.

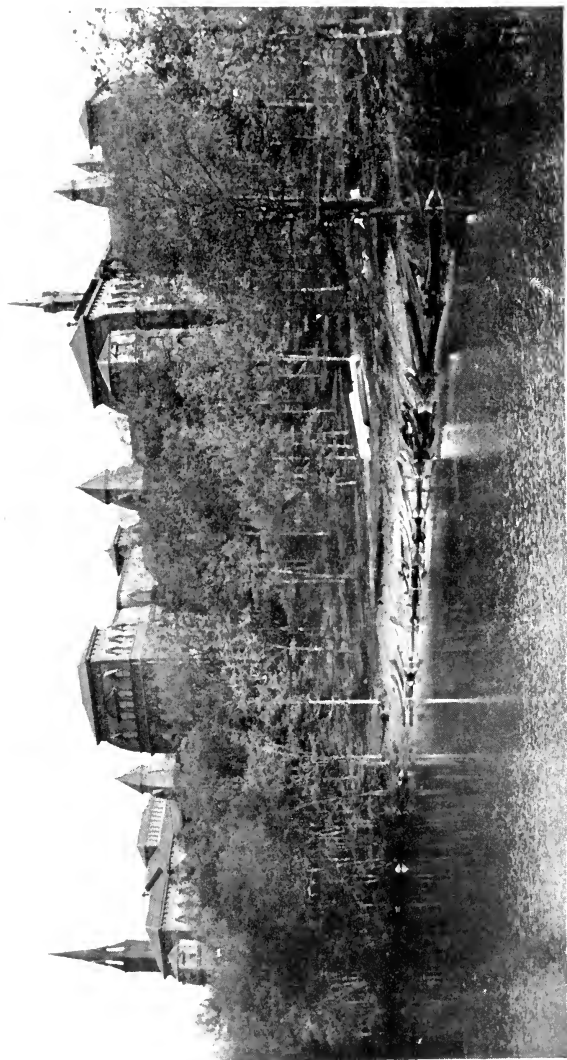
Tufts College has taken for ten years an advanced position in its requirements for admission, and has recognized a wide equivalence in educational values.

The plant of the college comprises fourteen buildings: Ballou Hall, containing class-rooms, the physical and electrical laboratories, and the offices of the President, Secretary, and Registrar; Goddard Chapel; the Barnum Museum, with thoroughly equipped biological and geological laboratories and a choice collection illustrating the various branches of natural history; the Goddard Gymnasium; three men's dormitories; the Library Building, containing thirty-five thousand bound volumes and about sixteen thousand pamphlets; Commons Hall, containing dining-hall and post-office; the Chemical

Building ; Miner and Paige Halls, respectively recitation hall and dormitory of the Divinity School ; the Bromfield-Pearson School, with machine shops and draughting rooms ; and Metcalf Hall, the women's dormitory.

The college term lasts from the middle of September until the middle of June. The tuition fee is one hundred dollars annually, except in the engineering courses, where it is one hundred and twenty dollars annually. There is a charge of ten dollars for physical culture, one dollar for the reading room, and some minor charges for material used by students working in the laboratories.

The college publishes a comprehensive catalogue yearly, and the Tufts College Studies, embodying the results of original scientific investigations. The President of the College is Rev. Elmer H. Capen, D.D.



WELLESLEY COLLEGE — COLLEGE HALL FROM LAKE WABAN

WELLESLEY COLLEGE.

The college is situated in the town of Wellesley, fifteen miles west of Boston. It is readily accessible by the Boston & Albany Railroad, and is connected with the Newtons and adjoining towns on the east, and with South Framingham on the west, by electric lines.

WELLESLEY is a college for women exclusively, and was founded by Henry F. Durant, a Boston lawyer. It was incorporated in 1870 under the laws of Massachusetts, with power to "confer such honors, degrees, and diplomas as are granted or conferred by any university, college, or seminary of learning in this Commonwealth," and was opened in 1875 with 26 instructors and 300 students. It has now conferred the Bachelor's Degree upon nearly 1,600 young women; the Degree M.A. upon 64. Its curriculum is broadly elective, the element of choice entering into about four-fifths of the work requisite to the first degree. Twenty-three departments offer 206 courses. The teaching force numbers 76. The library contains upwards of 48,000 volumes.

College Hall, the first building, is still the administrative centre and the largest dormitory. It contains also the library, the present chapel, lecture and class rooms, as well as several laboratories. Stone Hall and seven cottages complete the dormitory capacity. Music, chemistry, and art are provided with separate buildings, and a new chapel is in process of erection.

From the start, Wellesley has aimed to give full opportunities for the study of science. In the third year of its work the college had already distinct departments of botany, physics, chemistry, and zoölogy, separately officered. The study of geology and mineralogy was organized as a distinct department in 1886. A brief statement of the equipment and scope of each department is subjoined.

The subject of Botany is accommodated with ample quarters at Stone Hall. These consist of three separate laboratories for the use of students in general morphology, cryptogamic and physiological botany, with lecture-rooms, herbarium, and private laboratories.

Undergraduate courses begin with study of general morphology and principles of classification. Advanced systematic and economic botany occupy a second year. Alternative with this is a study of the leading groups of cryptogams. A third year offers vegetable histology and physiology, alternative with a course in medical botany. Graduate work, involving independent laboratory investigation, is conducted in two courses: embryology and other special topics, and advanced study of cryptogamic groups. Laboratory work is followed by recitations, demonstrations, and lectures. The laboratories furnish microscopes, microscopical accessories, physical and chemical appliances, and other requisites for independent research. The botanical club gives stated opportunities for general discussion. The herbarium numbers 14,000 species, and the botanical museum 4,000 specimens. The botanical library contains 16,000 volumes and 1,200 pamphlets.

The laboratories of the Department of Zoölogy are on the fourth and fifth floors of College Hall. The

courses offered are as follows: one in general biology, illustrative of the fundamental principles which govern all life; one in general zoölogy, consisting of studies on the great types of animal life; one in vertebrate anatomy and embryology; one in histology; one in human and comparative physiology. In addition to these, one course is offered in the pedagogics of zoölogy and another in philosophic zoölogy, in which the great problems of the science are discussed. These courses are accepted as preparatory to the study of medicine. Opportunity is given for field work in the observation of animals in their haunts, and for the systematic study of their structure, functions, and development.

In Chemistry two lecture-rooms and five laboratories, supplied with all necessary apparatus, offer accommodations for 225 students. The seven courses cover general chemistry, qualitative and quantitative analysis, organic chemistry, and chemical theory.

The chemical laboratories are in a separate building, which contains a reading-room, library, and large lecture-room, in addition to general chemistry, analytical and organic laboratories. The rooms are all conveniently arranged, and well equipped with modern appliances for successful work.

The Department of Physics, located at College Hall, occupies a lecture-room, a private laboratory, laboratories for students, dark rooms for photometry and photography, a dynamo and engine room, and a carpentry and repair room with lathe. The apparatus, which includes fine instruments of precision, is valued at \$13,000. The work offered aims to give a thorough knowledge of the foundation principles of physics, and of the experimental and mathematical methods by

which these have been discovered. Courses in meteorology and physical astronomy are also conducted by the department.

The Department of Geology and Mineralogy offers, in addition to introductory general courses in these subjects, a course in advanced geography. Interpreted by the light of geology, the physical features of the land become more significant to the student, while the influence of these features upon the customs and conditions of the inhabitants gives the subject a living interest.

The fee for tuition is \$175 per annum; that for board, \$225. The college is practically without endowment for general uses. Supplied by the founder with ample and attractive grounds and with the nucleus of a fine equipment, Wellesley remains to-day dependent upon receipts from board and tuition fees for running expenses and repairs, for new buildings, and all other enlargement upon the original outfit.

The President of the college is Dr. Julia J. Irvine. The President of the Board of Trustees is Rev. Alexander McKenzie, D.D.

BOSTON COLLEGE.

The college proper is situated upon James street, near the New England Conservatory of Music, but entrance into the building may also be made from the residence of the professors, 761 Harrison avenue.

BOSTON COLLEGE, the leading Catholic educational institution in Boston, was incorporated on May 25, 1863; classes were first opened on Sept. 5, 1864. The college is under the direction of the Fathers of the Society of Jesus, and follows the traditional methods of the famous "Ratio Studiorum," with those additions to the course that have been called for by the progress of modern times. Beginning with twenty-five students and steadily increasing year by year in numbers, it now has nearly five hundred pupils upon its rolls.

Education is understood by the Jesuit professors as the full and harmonious development of all those faculties that are distinctive of man. Such studies, sciences, or languages are consequently chosen as will most effectively further this end. If two or more sciences give similar training to some mental faculty, that one is chosen which combines the most effective training with the largest and most fundamental knowledge. The studies, therefore, are so graded and classified as to be adapted to the mental growth of the student and to the scientific unfolding of knowledge; they are so chosen and communicated that the student may gradually and harmoniously reach that measure of culture which belongs to a college graduate.

It is fundamental in the system of the Society of Jesus that different studies have distinct and peculiar educational values. Mathematics, the natural sciences, language and history, are *complementary* instruments of education to which the doctrine of equivalence cannot be applied.

The principal work of the first two years of the collegiate course is the training of the imagination and the cultivation of literary taste and style. The development of the critical powers is the main purpose of the third year. The last year of the course develops the reasoning powers by the severe discipline of logic, metaphysics, ethics, higher mathematics, and natural sciences.

The President of the college is Rev. W. G. Read Mullan, S.J.

THE LOWELL INSTITUTE.

THE LOWELL INSTITUTE, one of the most important and noteworthy of the educational establishments of Boston, is peculiar in that it has no buildings, but provides annually numerous courses of instruction — elementary, popular, and advanced — in a great variety of subjects.

The Lowell Institute was founded by John Lowell, Jr., of Boston, merchant, who died in Bombay, March 4, 1836, leaving by will one-half his fortune for the support of free public lectures in the city of Boston. The foundation became operative on Dec. 31, 1839, when a series of free public lectures of the highest class was inaugurated with an address by Edward Everett, who was followed in order by Prof. Benjamin Silliman, Sr., of Yale, on Geology, Dr. John G. Palfrey on the Evidences of Christianity, and Prof. Thomas Nuttall, of Harvard, on Botany.

The responsibility of giving form, success, and usefulness to the bequest of the founder rested upon his cousin John Amory Lowell, who was constituted by him sole Trustee with power to appoint his own successors, each Trustee, successively, to have similar powers; the only restriction being that preference must be given to some competent male descendant, if any, of the testator's grandfather, and of the name of Lowell.

At the time of the establishment of the lectures (in 1839–40) the fund of the Lowell Institute amounted to

about two hundred and fifty thousand dollars; but under the operation of a singularly wise provision of the testator, by which a portion (one-tenth) of the income must be added annually to the principal, and under the able financial management of the original Trustee, John Amory Lowell, and the present Trustee, his son and successor, Augustus Lowell, the fund has not only allowed the number of lectures annually given to be multiplied many fold, but has also made it possible for the Trustee to increase the sums paid to lecturers — thus steadily maintaining and raising the standard of instruction, while yet greatly extending its range. At the same time the principal fund has been faithfully conserved and materially strengthened.

According to the will of the testator no money can be spent in buildings. Hence the lectures must be given in halls leased or donated for the purpose. At present, between five hundred and six hundred free public lectures are annually provided by the Lowell Institute. The principal (popular) series is given in Huntington Hall, Massachusetts Institute of Technology. Another series of more advanced and special lectures, often to small classes, is given by professors of the Massachusetts Institute of Technology, in the class-rooms or laboratories of the Institute. Lectures to teachers are given under the auspices of the Boston Society of Natural History; lectures to workingmen and others, under the auspices of the Wells Memorial Institute and the Young Men's Christian Association. A school of design, known as the "Lowell Free School of Practical Design," is also maintained, under the auspices of the Massachusetts Institute of Technology.

Some of the most eminent men of their time have

been lecturers in the Lowell Institute, and more than a hundred volumes have been published corresponding to, and largely the outcome of, lectures delivered before it — the total number of which is now more than four thousand.

The work of the Lowell Institute is directed by the sole Trustee with the assistance of Prof. William T. Sedgwick, the Curator.

Further information may be found in "The History of the Lowell Institute," by Harriette Knight Smith. (Boston: Lamson, Wolffe, & Co.)

AMERICAN ACADEMY OF ARTS AND SCIENCES.

10½ Beacon street, near the State House. Open from 10 A.M. to 1 P.M. and (Saturdays excepted) 2 to 4 P.M.

THIS is the oldest scientific body in the State and with the exception of the American Philosophical Society of Philadelphia, in the country. The Commonwealth granted it a charter while the Revolutionary war was in progress (May 4, 1780), and among its charter members were John and Samuel Adams and John Hancock. John Adams, John Quincy Adams, and Charles Francis Adams have been successively Presidents, their united incumbencies covering thirty-nine years. It was enacted in the charter that the first meeting should be called by Governor Bowdoin (who became its first President) "in the philosophy chamber in the University of Cambridge." The "design and institution" of the Academy were stated at length, closing with the words: "in fine, to cultivate every art and science which may tend to advance the interest, honor, dignity, and happiness of a free, independent, and virtuous people." George Washington was chosen a Fellow at the first election held.

It is now divided into three classes, covering the "physical and mathematical," the "natural and physiological," and the "moral and political" sciences; and each class is subdivided into four sections, a member being elected definitely into only one of these. There are three groups of members: Resident Fellows, residing in the Commonwealth, and limited to two hundred; Associate Fellows, other Americans, including Cana-

dians, limited to one hundred; and Foreign Honorary Members, limited to seventy-five. The roll is kept very nearly full, the last published containing 356 names.

The Hall of the Academy is at present in the Athenæum Building on Beacon street, but it will shortly be removed to new quarters with the Massachusetts Historical Society on Boylston street. The Hall contains a few interesting portraits, but little else except the library, consisting of about 26,000 volumes. It is richest in the departments of physics, chemistry, technology, and mathematics, and in the publications of learned bodies with which it stands in friendly relations. Meetings are held here once a month excepting in the summer, and the papers then presented form latterly a yearly volume of Proceedings.

The Academy has no large endowment of its own, but it has long been the administrator of a responsible trust, founded by Count Rumford, for the advancement of the knowledge of light and heat and of their practical applications. By means of this a part of the expenses of its publications are defrayed, and it confers the Rumford medals as a premium to the author of any important discovery or useful improvement in light or in heat (made in America), preference being given to those which tend most to promote the good of mankind. Through this fund also, and through the recently founded C. W. Warren fund, considerable grants are yearly made in aid of physical and chemical research.

The publications of the Academy consist of 33 volumes of Proceedings in 8vo, 16 volumes of Memoirs in 4to, and the Life and Works of Count Rumford in 5 volumes, 8vo.

Mr. Alexander Agassiz is President of the Academy, and Messrs. Samuel H. Scudder and William Watson, Secretaries.

BOSTON SOCIETY OF NATURAL HISTORY.

Berkeley, Boylston, and Newbury streets. Open from 9 A.M. to 1 P.M. and from 2 P.M. to 5 P.M.

THIS society was preceded by a short-lived association known by the name of the Linnæan Society, which after a checkered career finally dissolved in 1823. In a few years the desire for a natural history society revived, and the present organization was initiated in 1830, and moved into its present building in 1864, on land given by the State. From its foundation the society assumed a more popular character in distinction from its older sister in Boston, the American Academy, which has a restricted membership. The object of the society is the promotion of all the natural history sciences, which in practice comprise anthropology, zoölogy, botany, palæontology, geology, and mineralogy. It maintains a general museum, which includes a large amount of valuable material, in part unique, and a library, which is very rich in long series of the publications of learned societies of all countries, and in scientific journals, being in both fields by far the best library of natural history in New England. The society has also issued a valuable series of publications, as follows:

Proceedings, 8vo, volumes 1-28.

Journal, 8vo, volumes 1-7.

Occasional Papers, 8vo, volumes 1-4, parts 1 and 2.



BOSTON SOCIETY OF NATURAL HISTORY.

Memoirs, 4to, volumes 1-5; and a memorial volume in 1880.

Museum Guides, 8vo, volumes 2-3.

At present the society aims to distribute, in parts as printed, at least one volume of Proceedings annually, and part of a volume of Memoirs. Both series are illustrated with numerous plates. The society carries out extensive educational functions, partly by offering facilities and laboratory opportunities to Boston University, partly in coöperation with the Lowell Institute by lectures and laboratory courses to the teachers of the schools of Boston and of the neighboring towns.

The society has long held a high position in the community, and has done much for the encouragement of young students, so that a very large proportion of the naturalists of this section of the country are much indebted to opportunities afforded by the society.

The first president of the society was Thomas Nuttall, the well-known ornithologist and botanist. The society depended at its start chiefly upon voluntary efforts, and among those who thus served the interests of science we find many who distinguished themselves as naturalists in the early part of this century. Among the active early supporters of the society we may enumerate: B. D. Greene, Amos Binney, C. T. Jackson, A. A. Gould, T. W. Harris, Jeffries Wyman, G. B. Emerson, Louis Agassiz, Henry Bryant, Henry B. Rogers, D. H. Storer, W. I. Burnett, and J. C. Warren, and the list might easily be extended. The early life of the society was simple, but it was so well sustained that its collection of books and of specimens soon outgrew the limited accommodations of the society. About 1860 the need of a new building became imper-

ative. Through the very liberal contributions of Dr. William J. Walker the society was enabled to make so strong an appeal to the public that the balance of the necessary funds for a new building was secured. The Legislature of the State, thanks to the energetic pleas of Prof. W. B. Rogers and Mr. M. D. Ross, presented to the society the land upon which its building now stands. This dignified and handsome edifice was erected in 1863, and has since remained without essential alterations. The original cost of the building was a little over \$100,000, and its construction was exceptionally thorough and careful. It is, however, at present too small for the needs of the society, and it is hoped to enlarge it in the near future. It contains, besides the library and the museum, a lecture hall and a laboratory.

The museum of the society was reorganized upon a comprehensive plan designed by Prof. Alpheus Hyatt, who has been the curator since 1870. This plan embraces a synoptic collection, and the introductory portion of this collection is what the visitor first encounters upon entering the building. The synoptic collection embraces a general part, to illustrate the principal materials, forms, and forces with which the naturalist has to deal, and a systematic part. Secondly, there is a New England collection which, though not absolutely complete, is, in most departments, very nearly so. Finally, there is displayed a special collection of birds in the uppermost part of the museum, the greater part of which — the Lafresnaye Collection — was the gift of the late Dr. Henry Bryant. Among the many specimens in the museum of special interest and value, there may be mentioned more particularly a large number of type specimens, especially of birds,

and a smaller number of types of insects and of other invertebrata. Allusion must be made to the skeleton of the gorilla which was brought to this country by the Rev. Mr. Savage and furnished Dr. Jeffries Wyman the opportunity to draw up the first thorough scientific description of the skeleton of this anthropoid. Conspicuous also is the large skeleton of a whale suspended from the ceiling of the main hall, which has been described in a special memoir by Dr. Thomas Dwight. The Pratt Collection of shells is well known to all conchologists, and is of very great value. It was bequeathed to the society in 1867 by Miss S. P. Pratt, together with a fund of \$10,000 for the maintenance and increase of the collection. Also well known to specialists is the Lowell Herbarium, presented by John Amory Lowell, the Eser Palæontological Collection, presented by John Cummings, and the Harris Collection of insects. The most definite conception of the plan upon which the society hopes to have all its collections arranged can be gathered from the examination of the mineralogical and geological collections upon the first floor.

The library contains at present over 37,000 volumes and pamphlets. As it is consulted chiefly by students and investigators, it is not maintained as a reference library merely, but members are allowed to take out books for long periods so as better to facilitate thorough study, especially on the part of those who are pursuing original investigations. The library possesses in addition to its books several interesting portraits which deserve attention; among the oils are included J. J. Audubon in hunting costume, by Healy; Louis Agassiz, by Mrs. Alexander; Alexander von Humboldt,

by Wight; and Thomas Nuttall. The library and publications owe very much to the successful energy of Mr. Samuel H. Scudder, followed later by Mr. Edward Burgess. The former was librarian from 1864 to 1870, and under his care the library nearly doubled in size in six years. Mr. Scudder was subsequently president of the society. Mr. Burgess was secretary from 1872 to 1888. He had distinguished himself as an entomologist before he achieved fame by his genius for yacht building.

The society now has a permanent fund created principally by the bequests of public-spirited citizens of Boston, amounting to some \$200,000.

Meetings are held twice a month, from November through May, and are often largely attended. The average attendance is over eighty. The meetings being open to the general public, especial efforts are made to have communications presented which shall be of general interest, while other meetings are made of a more specially scientific character. It is customary to allow such communications as are offered for publication by the society, but are not read in open meeting, to be presented by title, to secure their consideration for publication by the society.

Dr. W. J. Walker, who, as before mentioned, has been the largest single benefactor of the society, established two prize funds, one of which is given annually for essays on special themes determined by a committee, and a larger prize, usually of a thousand dollars, which is given not oftener than once in five years, for distinguished original investigations made in this country in the domain of the natural history sciences. This prize has been awarded five times, as follows: in 1873 to Dr. Alexander Agassiz; in 1880 to Prof. Joseph

Leidy; in 1884 to Prof. James Hall; in 1892 to Prof. James D. Dana; and finally, in 1898, to Dr. Samuel H. Scudder.

Dr. Charles Sedgwick Minot is president of the society; Prof. Alpheus Hyatt, the curator; Mr. Samuel Henshaw, the secretary.

WARREN MUSEUM OF NATURAL HISTORY.

The Museum is at 82 Chestnut street (near Charles street), and is open from 3 to 6 P.M., during the meeting of the American Association.

THIS museum was incorporated by the Legislature February 19, 1858. It contains many valuable specimens collected by the late Dr. John C. Warren. The central feature is the skeleton of a mastodon, perhaps the finest in the world, which was discovered near Newburg, N.Y., in 1845, and purchased by Dr. Warren in 1846. There is also a fine skeleton of an elephant, and another fine mastodon head, as well as many teeth. A fossil skeleton of the Zeuglodon cetoides, some sixty feet long, is arranged around the lower hall. There are several slabs containing fine fossil footprints and various other curiosities.

According to the will of Dr. Warren his children were made a corporation to hold this collection for the benefit of the surviving grandchildren.

MASSACHUSETTS HORTICULTURAL SOCIETY.

The building of the society is at No. 101 Tremont street, Boston, and is open to visitors at any time.

THE MASSACHUSETTS HORTICULTURAL SOCIETY was established in 1829, for the purpose, as stated in the Act of Incorporation, "of encouraging and improving the science and practice of horticulture, and promoting the amelioration of the various species of trees, fruits, plants, and vegetables." The means by which it has been sought to effect the objects of the society are, first, horticultural exhibitions; second, lectures; and third, the library.

The exhibitions were established very soon after the formation of the society, and since then there has been hardly a Saturday when some horticultural product has not been shown, besides exhibitions lasting from one to four days and evenings. At these exhibitions about two hundred thousand dollars has been awarded in prizes.

In 1887 an exhibition of window gardening by children was commenced, which has since developed into an exhibition of school gardens and children's herbariums. This movement has excited much interest throughout the country, and it is believed has done much to train children to a knowledge and love of

botany and horticulture, and to cultivate the powers of observation in our young people.

The lectures and discussions before the society were begun in 1874, and have been continued through the winter of every succeeding year, about twelve lectures or discussions having been held each season. They are free to all.

From its formation the society began the publication of an annual pamphlet containing an account of its doings, and this has been continued, with some variations of form, until the present day. From 1846 to 1852 its Transactions were published in imperial octavo with colored plates. Beginning with 1874 the lectures and papers read before the society have been published in full, with the substance of the discussions. These publications now fill thirteen thick octavo volumes. In 1880 a History of the Society for the first fifty years was published.

The library will probably be of more interest to scientific visitors than any other part of the society's work. This, like the exhibitions, was begun very soon after the formation of the society, and has grown so that it is now the best horticultural and botanical library in this country, and is excelled by few in any part of the world.

Books on botany and horticulture illustrated with plates, colored plates being preferred when obtainable, have been specially sought. The library is open every day during business hours, and is free to be consulted by any one.

The President of the society is now Gen. Francis H. Appleton.

APPALACHIAN MOUNTAIN CLUB.

Club-rooms, Tremont Building 1049-1051. Open to visitors weekdays from 3 to 5.30 P.M.

THIS club, founded in 1876, incorporated in 1878, and now numbering over 1,000 members, owes its existence to a movement of leading scientific men in New England to provide for a more complete study of the then imperfectly explored White Mountain region, together with the fostering of a fondness for the exercise of mountain climbing. Among its founders were Edward C. Pickering, Samuel H. Scudder, T. Sterry Hunt, Edward S. Morse, William H. Niles, Charles R. Cross, C. H. Hitchcock, and Count Pourtalès.

Although its original field of work was long since quite fully explored, new interests have meantime constantly arisen, so that the society has never lacked some kindred object worthy of its effort. Its early claims for recognition as a geographical society have of late been supported through the part taken by its members in the exploration of the glacial regions of the Rocky Mountains of Canada, and in increasing its knowledge of this noble field for study and for Alpinism. Here at home, besides its interesting monthly meetings (at the Institute of Technology, its birthplace), its weekly "outings," and its occasional longer excursions, whereby hundreds have been made familiar with the

wider aspects of Nature, it has taken an active part in important public enterprises. The Massachusetts system of Metropolitan Parks could scarcely have existed but for the previous creation of the Trustees of Public Reservations, which body was the direct outcome of a movement started by the club in 1890. The preservation of the forests, especially in the mountain regions of New England, has also interested it, and an extension of the club's charter in 1894 enables it to hold (exempt from taxation when unproductive) all forest lands in this Commonwealth that it may acquire by gift or purchase. It has already several minor holdings in New Hampshire and one in Massachusetts.

At the club-rooms are its library, over 1,000 volumes chiefly of Alpine and geographical publications, and its collection of maps and photographs. The superb "Sella Collection" of nearly 500 views in the Alps and the Caucasus is usually absent on exhibition in other cities, under a system of loan to responsible societies. By the courtesy of the Boston Art Club, arrangements have been made for exhibiting the collection at the club house, Dartmouth and Newbury streets, during the meeting of the American Association.

The annual income is about \$3,000, chiefly from admission fees (\$5) and annual assessments (\$3). The principal items of expenditure, apart from room-rent and ordinary expenses, are for the building and maintenance of paths, shelters, etc., in the White Mountains, and for publications. "Appalachia," the journal of the club, is an 8vo magazine, richly illustrated, of about 100 pages per number (four numbers to the volume), appearing once or twice a year. Eight volumes are now complete.

The President of the club is Prof. W. H. Niles. The Register of 1898 (12mo, 60 pages), with full information concerning the club and containing a list of officers and members, will be sent on application to R. B. Lawrence, Recording Secretary, 745 Tremont Building, Boston.

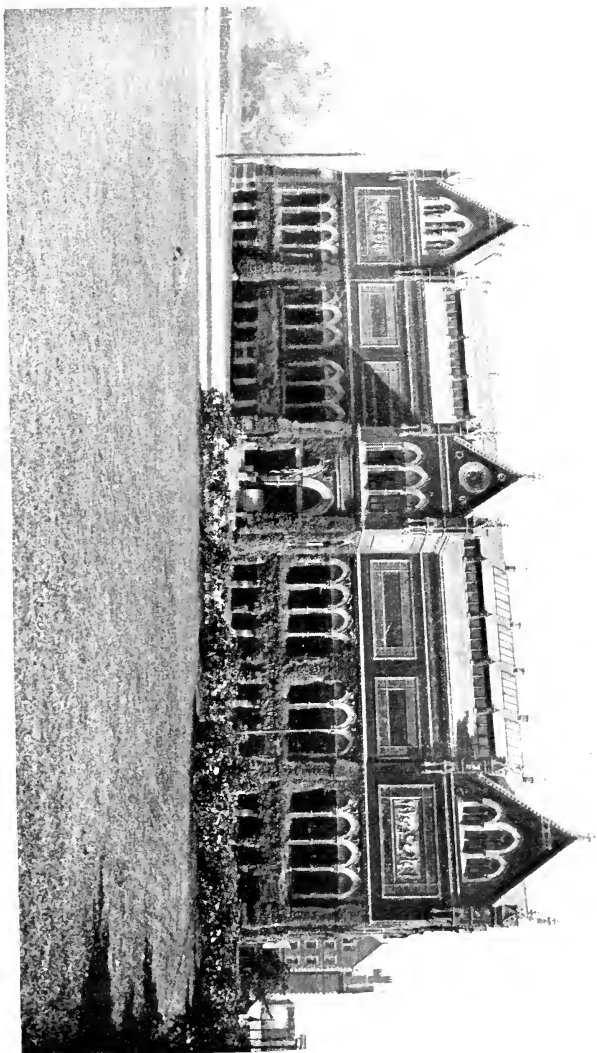
By invitation of the Local Committee the club will undertake the conduct of the various excursions offered to members of the American Association.

MUSEUM OF FINE ARTS.

The museum is situated on Copley square, at the corner of Dartmouth street and St. James avenue. It is open every week-day from 9 A.M. to 5 P.M., excepting on Monday, when it is closed until noon. On Sundays it is open from 1 to 5 P.M. Admission every day excepting Saturday and Sunday, 25 cents; on Saturday and Sunday free. By the courtesy of the Trustees, admission will be free during the meeting to members of the American Association wearing badges.

THE first suggestion of a public establishment in Boston to be devoted wholly to the fine arts was the result of a wish to make more accessible to the public several collections of works of art already existing in the city; notably the paintings and sculpture belonging to the Boston Athenæum, the collections of engravings belonging to Harvard College, and the casts of architectural ornament belonging to the Massachusetts Institute of Technology. In March, 1870, the Trustees of the Museum of Fine Arts were incorporated by an act which stated the purposes of the corporation to be the "preservation and exhibition of works of art, making, maintaining, and exhibiting collections of such works, and affording instruction in the Fine Arts."

The land now in part occupied by the museum building was the gift of the city; but apart from this gift the museum has been wholly dependent upon private liberality for its creation and maintenance. Subscriptions in which all classes in the city have joined have provided the funds successively for the first wing on



MUSEUM OF FINE ARTS.

St. James avenue (opened July 3, 1876), the completion of the St. James avenue front (1879), and its enlargement (1890) by two wings and a connecting corridor, making a hollow square about a central court.

The museum is managed by a board of thirty Trustees, of whom three are appointed by Harvard College, three by the Boston Athenæum, and three by the Institute of Technology ; there are five ex-officio members, of whom three, including the Mayor, represent the city of Boston ; the remainder of the board are those first named in the act of incorporation and those chosen by the board to fill vacancies in its number. An Executive Committee has the care of the building, and the Committee on the Museum has the direction of the collections. The President of the Board of Trustees is Mr. William Endicott, Jr. The museum has been from the beginning under the immediate charge of Gen. Charles G. Loring, the present director. Since the first opening of the museum the use of rooms in the basement and attic of the building has been granted by the trustees for a School of Drawing and Painting, which has given instruction of the highest quality, and is attended annually by about 200 pupils.

On the first floor of the building the outer rooms are occupied by a large collection of casts of sculpture, while three rooms on the court contain collections of Egyptian and of classical antiquities. The collection of casts is arranged in the main chronologically, beginning with Egyptian and Assyrian sculpture in the room on the right of the entrance, and running around the building through the large collection of classical sculpture and that of the Italian, French, and German Renaissance, to modern American sculpture in the room on

the left of the entrance. The collection of original objects from Egypt is one of great interest, while that of Greek vases, sculpture, and other objects affords a very uncommon opportunity for acquaintance with the original work of classical artists.

On the second floor, the picture galleries and the rooms devoted to exhibitions of prints occupy the whole east wing of the building, to the right on reaching the head of the stairs. The first three rooms contain pictures of older date, the first largely Italian, the second American (Allston room), the third Dutch. The fourth and fifth picture galleries contain the work of contemporary artists. In the Allston room are found several portraits of celebrated Americans, foremost among them the "Athenæum" heads of Washington and Mrs. Washington, by Stuart. To the left of the stairway hall is the gallery of textiles; beyond, those of pottery and porcelain, wood carving, metal work, and coins and jewelry. A large room beyond and the whole of the corridor are devoted to the collection of objects of Japanese art, which in every department is the largest and richest in the world. In the corridor, in cases between the windows, is the Morse collection of Japanese pottery, a more complete representation of the fictile art of Japan than all other existing collections combined.

The museum publishes the following catalogues of its regular exhibitions :

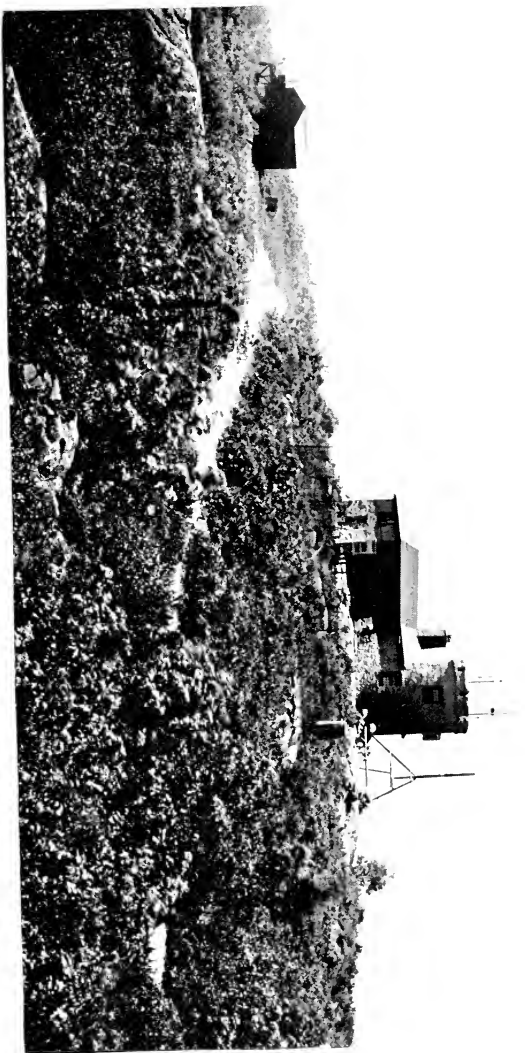
Casts of Classical Sculpture. (Revised edition,	
1896.)	\$0 50
Greek Vases. (1893.)	1 00
Paintings and Other Objects on the Second Floor.	
(1898.)	0 25

From time to time catalogues of special exhibitions are published, of which the latest is that of the exhibition of book plates arranged during the spring of 1898 by the Club of Odd Volumes of this city.

BLUE HILL METEOROLOGICAL OBSERVATORY.

The observatory is situated upon the summit of Great Blue Hill, about eleven miles south-south-west of Boston State House. It is most easily reached from Boston by trains from the Park Square station of the New York, New Haven, & Hartford Railroad, which leave at eighteen minutes past each hour and arrive at Readville in twenty-four minutes. From Readville a carriage may be taken to the base of Great Blue Hill (one and one-half miles), whence a foot-path leads in twenty minutes to the top of the hill. Although the hill is but 635 feet above sea-level, it is the highest land on the Atlantic coast between Maine and Florida, and commands a splendid view, extending seaward to Cape Ann (forty miles) and inland to Grand Monadnock Mountain (sixty-eight miles distant). Persons interested in meteorological work are always welcome at the observatory.

THE observatory was established as a private meteorological station in 1885 by A. Lawrence Rotch, of Boston, and it has since been supported and directed by him. With the exception of the municipal meteorological station in New York, the Blue Hill Observatory was the first in this country to be equipped with instruments which recorded graphically and continuously all the meteorological elements (excepting the forms and motions of clouds) usually observed at a station of the first order, and commencing with 1886 hourly values were printed. Two secondary stations with self-recording instruments are maintained on the Readville road, at altitudes of 50 feet and 200 feet, respectively, above the sea. Local weather predictions made daily at the observatory were published in the



BLUE HILL OBSERVATORY FROM THE NORTHEAST.

Boston newspapers until the Weather Bureau commenced similar forecasts in Boston, and they are still signalled by flags from the observatory to the neighboring towns. The work of the observatory, however, is mainly research, which is widely known to meteorologists through publication; clouds especially have been studied. The first series of measurements in America of the height and velocity of clouds, by trigonometrical and other methods, was made here in 1890-91, and the measurements were repeated during 1896-97 as a part of an international system. On Blue Hill, in 1894, the first meteorological instrument recording graphically and continuously, was lifted by kites, and the possibility of obtaining data simultaneously in the free air by means of kites and at the ground was thereby demonstrated. This method of exploring the free air has been perfected by the aid of a grant from the Hodgkins Fund of the Smithsonian Institution, and very valuable results have been obtained, automatic records of atmospheric pressure, air temperature, relative humidity, and wind velocity having been brought down from an altitude of ten thousand feet.

The Blue Hills were taken by the Commonwealth of Massachusetts for a public reservation and became a portion of the Metropolitan Park System (see page 81) in 1893, but the observatory was allowed to remain. In 1896 a portion of the summit of Great Blue Hill was leased by the Commonwealth for ninety-nine years to Harvard College, and it is hoped that the observations will be maintained under invariable conditions of exposure. The annual expense of maintenance, exclusive of publication, is about \$4,000, which is borne by the director, Mr. Rotch. The other members of the staff

are H. Helm Clayton, meteorologist; S. P. Fergusson, mechanician; and A. E. Sweetland, observer.

The observations for 1885 and 1886, as well as an account of the observatory, were privately printed; since 1887 the observations and discussions have been published, annually or oftener, in the "Annals of the Astronomical Observatory of Harvard College," at the joint expense of the university and Mr. Rotch. The following volumes of the "Annals" contain the Blue Hill work: Vol. XX.; Vol. XXX. (Part III., Measurements of Cloud Heights and Velocities; Part IV., Discussion of Cloud Observations); Vol. XL.; Vol. XLII. (Part I., Appendix B, Exploration of the Air by Means of Kites). During the present year three "Bulletins" have been issued by the observatory, giving prompt information of general interest.

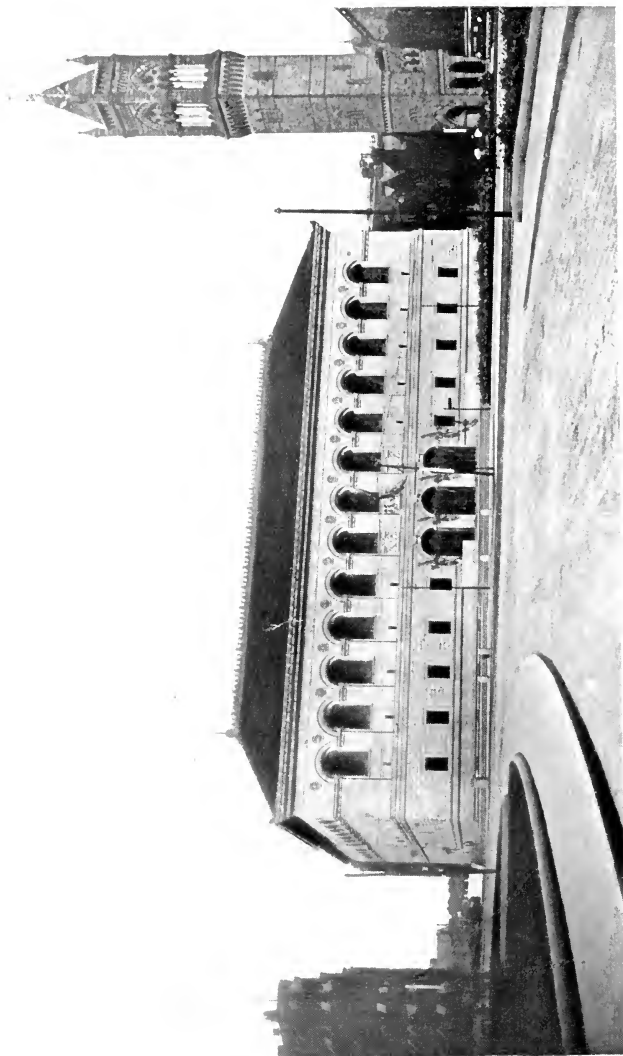
STATE LIBRARY OF MASSACHUSETTS.

The library occupies the northern end of the third floor of the State House Extension, and is easily reached by the elevators near any of the entrances to the building. It is open every week-day from 9 A.M. until 5 P.M., except Saturdays, on which day it closes at 2 P.M. Visitors are always welcome, and are cordially invited to make themselves known to the Librarian.

THE STATE LIBRARY was established in 1826, is supported by State appropriation, and has become one of the foremost State libraries in the country. It is solely a reference library, containing over 100,000 volumes, its primary function being to furnish the legislative, executive, and judicial departments of the Commonwealth with such information as they may require. Its collection of the statute law of all the American States, of Great Britain and all its dependencies, and of all the other countries of the civilized world is believed to be one of the best in existence. The official publications of the general government and of all the States, together with an extensive collection of the best works upon the legal, political, educational, social, and economic sciences, the biography of public men, the history, description, and resources of the different countries of the world, and the best reference books carefully kept up to date, are among the most notable features of the collection. Visitors may be interested in the modern features of the construction

of the steel stack, with glass floors, which affords opportunity for a model system of electric lighting, and in a novel electric book-lift. The original manuscript of Governor Bradford's history of the early years of the Plymouth Colony, which was returned to Massachusetts by the English Government at the request of Senator Hoar and with the coöperation of Ambassador Bayard, — one of the most interesting manuscripts in the world, — may here be seen.

Mr. C. B. Tillinghast is the Librarian.



BOSTON PUBLIC LIBRARY

BOSTON PUBLIC LIBRARY.

The central library building is located on Copley square. The addresses of the 27 branch libraries and Stations may be found in the Monthly Bulletin, to be had free on application, and in various other publications of the library. The central library is open for the reading and circulation of books from 9 A.M. to 10 P.M. on week-days, from 2 to 10 P.M. on Sundays and holidays, and closes in summer at 9 P.M.

A detailed description of the architecture of the building will be found in the Illustrated Handbook issued by Messrs. Curtis & Cameron, Copley square, and for sale at fifteen cents in the entrance hall.

THE PUBLIC LIBRARY of the city of Boston is a department of the city government maintained by annual appropriations. It forms therefore a part of the public educational system of the city. It is administered by a board of five trustees, who serve without pay, and of whom one is appointed annually by the Mayor for a term of five years. The board is, however, separately incorporated and empowered to take and hold property. The original plan of the library was a slow growth in the minds of prominent men of the city during the years from 1841 onward. In 1848 an enabling act was passed by the State Legislature, and on May 24, 1852, the date given as the founding of the library, the first board of trustees was organized with Edward Everett as president.

The first annual report of the trustees defined not only the policy of this library, but of free public libraries generally since that date. An immediate result of

this report was the gift of money and books to the amount of \$100,000 from Joshua Bates, a citizen of Boston then resident in London. Certain minor gifts both of books and money had preceded this. It was followed by many important gifts and bequests. To-day a large number of the most valuable books in the library belong in collections that have come in this way; and the trust funds (the interest of which, devoted to the purchase of books, amounted last year to \$11,000) aggregate \$265,000. The main income of the library, however, is the annual city appropriation, which, supplemented from various municipal sources, amounted in 1897 to \$251,000.

The following are the principal departments of the library system: Besides the central library with 530,000 volumes there are 10 branch libraries with independent collections of books aggregating 170,000 volumes; and 17 stations, some of which contain deposits of books, periodicals, etc., from the central library for reading and reference, while others are stations for the delivery of books. To all of these 27 outlying districts the library wagons and local expresses make daily trips for the exchange of books and cards with the central library. The delivery or deposit of books is also undertaken in 5 schools, 3 reformatory institutions, and 22 fire-company houses, making in all 57 outlying stations for the reading and circulation of books. On Feb. 1, 1898, there were 65,000 card holders entitled to draw books for home use. This is an increase of eighty-six per cent. in the number of card holders within the last two years. During the same time the circulation of books for use at home has increased forty-one per cent.

In the central library the main Reference and Read-

ing Room, known as Bates Hall, contains about 8,000 volumes on open shelves. These are for free consultation by any visitor without the intervention of an attendant. The Children's Reading Room contains some 7,000 volumes for reading and issue. The Patent, Periodical, and Newspaper Reading Rooms are for reference and reading only, although certain current magazines circulate from the Issue Department. The number and range of the periodicals and newspapers supplied will be found in the Annual Report for 1898.

In the Fine Arts Department drawing tables and certain other conveniences for students and copyists are furnished. From the reference collection of photographs supplementary to the books of this department, as well as through the generosity of citizens, exhibitions of material of interest on special occasions are hung from time to time in the Fine Arts Room, where also illustrated free lectures are given. In this department, classes pursuing systematic study in history, the fine arts, etc., and travel clubs, are encouraged to apply for special assistance in the way of illustrated books, portfolios, and photographs. The library contains also Binding and Printing Departments, the former of which does all the book-binding, mounting of maps, etc., of the library, with the exception of the cheapest grade of binding. The Printing Department contains a small but complete modern plant, including two Mergenthaler "linotype" machines, fonts of hand type, a Hoe stop cylinder press, two job presses, etc.

The central library building stands on land a large part of which was the gift in 1888 of the Commonwealth. It is in the Italian Renaissance style, quadrangular, surrounding a court, and cost at the time of

opening in March, 1895, including all decorations contracted for, some \$2,400,000. Certain alterations are now under way, principally in the administrative portions of the building, which are intended greatly to increase the efficiency of the library in the handling and issue of books, and to improve the heating and ventilating systems.

Entering through the main entrance on Dartmouth street, the only public room on the ground floor is the Periodical Reading Room. This is off the right-hand corridor. To right and left, the corridors lead to the granite arcade surrounding the court and fountain. The main staircase breaks at the landing; to the right, it leads to the Children's Room, Patent and Newspaper Reading Rooms; to the left, to the Issue Department and Librarian's Room. Bates Hall, the entrance to which is beneath the main decoration by M. de Chavannes at the head of the staircase, extends across the entire front of the building. Descriptions of the main decoration and eight panels by M. de Chavannes will be found on cards in the balustrade.

The decorations by Mr. E. A. Abbey in the Issue Room, called the "Quest of the Holy Grail," are described on cards to be found at the Issue Desk. When completed these decorations will extend around the room. At the southern end of Bates Hall next the Issue Room is the public card catalogue, the main index to the books of the library. It contains nearly a million cards arranged as a dictionary, with authors and subjects in one alphabet, and a great many cross-references. In Bates Hall are two stations from which attendants direct inquirers and supply information; and throughout the library, attendants in particular departments

are expected to supply information concerning the material which they have in charge.

The stacks of the library containing the main collection are on six floors in the southern wing back of the Issue Room. They are open to the public on request for inspection, but not for the purpose of study. From them, however, readers in Bates Hall may receive their books in from five to eight minutes. The Trustees' Room, a rich room furnished in the empire style, is on the mezzanine floor in the southern wing back of the Issue Room. The Newspaper Reading Room, containing some 320 newspapers from all the principal cities of the world, is reached through the Children's Room and Patent Room.

The third or special libraries floor contains the Barton-Shakespeare Library, the best collection of Shakespeariana outside of England, the Ticknor Spanish and Portuguese Library, the Prince and Lewis Libraries of Americana, the Library of John Adams, the Allen A. Brown Library of Music, the Twentieth Regiment Memorial Library, the Codman collection of books relating to landscape architecture, the Galatea collection of books relating to the history of woman, and certain other of the special collections of the library. The decoration by Mr. John S. Sargent is in the main corridor at the head of the staircase. The subject is a religious one, the part already in place representing the struggle of Judaism with polytheism. The decoration when completed will occupy the entire corridor. Descriptive cards will be found on the balustrade. In the Fine Arts Room, from time to time, exhibitions of books, bindings, photographs, etc., are held. The various special libraries in the north, west, and south wings will be found by inquiry of the attendant.

A full list of publications of the library may be found on the back of the current issues of the Monthly Bulletin. Among those for free distribution are the following:

Monthly Bulletin of new books added. This publication will be sent by mail for twenty-five cents a year.

Annual Reports. The report for this year (1897-8) contains photographs of the central library building and several branch library buildings, a map of the library system, and floor plans of the central library building.

Publication of the Quarterly Bulletins was discontinued in 1896. A list of the special bibliographical material contained in them, *e.g.*, fac-similes, lists of books on special subjects, etc., will be found on the back of current issues of the Monthly Bulletin.

In the Department of Science the library recognizes the proximity of Harvard University, the Institute of Technology, the Natural History Society, and other institutions, and its purpose is not to duplicate, unnecessarily, items in these other collections, in the case of very costly, highly specialized material. It has recently published a union list of the scientific and other serials currently taken in 36 libraries of Boston and vicinity, the material for the list being furnished in coöperation; and it is one of five engaged in the coöperative indexing of some 160 important scientific serials. Its share of this work is in the hands of Mr. John Murdoch, well known as an anthropologist, and for five years librarian of the Smithsonian Institution. The library has had the benefit of the expert assistance of Mr. Murdoch during the past year and a half.

A recent gift to the library of the library of the

American Statistical Association has formed the occasion for the enlargement of a special department of work in connection with documentary, statistical, and economic material, to be organized under the direction of Mr. Worthington C. Ford, late chief of the Bureau of Statistics at Washington.

The library is a free public library, no charge being made for the use of the material in the various departments, either by residents of the city who have the right to take books from the library, or by any visitor to the city for use in the building.

Hon. Frederick O. Prince is the Chairman of the Board of Trustees. Mr. Herbert Putnam is the Librarian.

BOSTON ATHENÆUM.

No. 10½ Beacon street, near the State House.

THE BOSTON ATHENÆUM had its origin in the "Monthly Anthology," a magazine first published in 1803. The persons interested in this periodical formed the Anthology Club, and collected a library which was incorporated in 1807 as the Boston Athenæum. Quarters were found first in Congress street, then in Pearl street (1821), and later in the present building at 10½ Beacon street (1849). For many years the Athenæum had a valuable art gallery, but the best paintings have been transferred to the Museum of Fine Arts.

The Athenæum is managed by trustees elected by its 1,049 shareholders, known as "proprietors." The income is derived from invested funds, and from an annual assessment upon each share in use. It possesses about 180,000 volumes, many of them rare; a large collection of Braun photographs and art works; files of early newspapers; the Bemis collection of works on international law, including State papers, etc., for the increase of which there is a substantial fund; one of the very best sets of United States documents in the country; and a large part of George Washington's private library, with many works relating to the first President. The Stuart portrait of Washington now at the Art Museum is owned by the Athenæum.

Some famous men of New England have been proprietors of the Athenæum, including John Hancock, Daniel Webster, Charles Sumner, Holmes, Parkman, and Prescott, and many famous books have been written beneath its roof. William F. Poole, who originated Poole's Index was at one time its librarian. A history of the first half century of the Athenæum was written by Hon. Josiah Quincy.

Mr. Charles Knowles Bolton is the Librarian.

At a meeting of the Standing and Library Committees, June 13, 1898, it was

“*Voted*, That the privileges granted to readers be given to members of the American Association for the Advancement of Science, and to guests of the Association, during the fiftieth anniversary meeting to be held at Boston, Aug. 22 to 27, 1898.”

BOSTON MEDICAL LIBRARY.

No. 19 Boylston place.

THIS institution was organized in 1875 and incorporated in 1877, with the object of maintaining a library of medical and scientific books, journals, and pamphlets for ready reference; of rendering current medical literature promptly accessible to physicians and students; of establishing a place of resort for the medical profession of Boston and vicinity, wherein shall be preserved the memorials, portraits, autographs, etc., of New England medical worthies.

The Association owns and occupies the house No. 19 Boylston place, which was formerly the residence of Dr. Samuel G. Howe; it has added a hall capable of seating two hundred persons, in which all the medical societies of the city hold their meetings; it has a library of nearly thirty thousand volumes, of which two-thirds are periodicals, including complete files of all the important journals, transactions of societies, etc., in English, French, German, and other languages; it has thirty thousand pamphlets; it receives regularly five hundred American and foreign medical journals; it has a collection of portraits of physicians and many thousand autographs.

The Association is supported by the annual dues (\$5) of its three hundred and fifty members, and by

contributions of medical societies, etc. It expects to extend its usefulness in the near future by erecting a new fireproof building upon a lot of ten thousand square feet at the corner of St. Botolph and Garrison streets, which it purchased five years ago.

In 1879 this institution devised, established, and has since conducted a Directory for Nurses, which has been copied in Philadelphia, New York, San Francisco, and many other cities. There are recorded the names and addresses of all the six or seven hundred nurses in the city, their present and future engagements, prices, and all other items of information that the employing public should know. For a small fee a nurse is supplied to any part of the country.

Dr. Oliver Wendell Holmes was President of the Boston Medical Library during the first thirteen years of its existence, and at his death bequeathed to it his valuable anatomical library.

The present President is Dr. David W. Cheever.

PARK SYSTEMS.

THERE are about 14,000 acres of land devoted to park purposes in Boston and its neighboring cities and towns. They include great areas of wooded wild lands, reservations of river-bank and sea-shore, and a number of most highly developed parks, playgrounds, and roads. They may be classified as local park systems, owned and cared for by the several municipalities within which they lie, and a Metropolitan Park System, owned and cared for by the State, acting in behalf of all these municipalities united for the purpose into a sort of Greater Boston, under the name of the Metropolitan Parks District. In acreage London and Paris surpass this Greater Boston, but in the variety and general character of its park lands no city is richer.

The local parks include commons, highly developed parks, playgrounds, and occasional small areas of woodland, beach, or hilltop which have been resorted to for generations, and for that reason have at last been taken into public ownership. At present, however, the tendency of the several municipalities is to confine their acquirements to the lands which are especially adaptable to use as local playgrounds, and to leave the desirable larger areas to be secured as portions of the Metropolitan Park System. This latter system was begun in 1893 by legislation which united Boston and 36 neighboring municipalities — that is, the suburbs for 12 miles about — into a Metropolitan Parks District, under

a Metropolitan Park Commission with ample power to acquire and make available open spaces for exercise and recreation throughout the district. This commission acts with regard to the district as a unit, and confines its acquirements in general to those notable areas which could not be acquired by a single municipality, because of their size or because only partially within its jurisdiction.

Certain of the local parks outside of Boston possess more than local interest. Such, for example, are Prospect Hill in Waltham (Fitchburg R.R.), from which a magnificent view may be had, and the Lynn Woods of 2,000 acres in Lynn (Eastern Division of B. & M. R.R.). The Lynn Woods is a most interesting and diversified reservation. From its hilltops the view seems that of a forest far from habitation. It has several miles of road which wind through wild scenery of woods, hills, and ponds. Close by its outer slopes lies the busy city of Lynn, with a population of over 62,000. Lynn and Swampscott have public beaches. Newton and Weston (Boston & Albany R.R.) have extensive holdings of wooded lands along the banks of Charles River.

The most notable of elaborately designed parks and playgrounds are those in Boston, Brookline, and Cambridge. Boston Common, 48 acres, is the largest and oldest; next, the Public Gardens, 24 acres, and Commonwealth avenue, were built upon filled marshes. They connect with the Fens, which were created by Frederick Law Olmsted out of an unsightly marsh at the mouth of Muddy River. The Riverway follows the valley of that stream, one bank being in Boston while the opposite is in Brookline. Similar park development has been continued through Leverett Park

to Jamaica Pond, on the shore of which the historian Parkman lived; thence to the Arnold Arboretum, used for the arboricultural studies of Harvard University, with specimens of nearly all the trees and shrubs hardy about Boston, and a growth of remarkably fine old hemlocks; thence to Franklin Park, of 600 acres, — Boston's largest and most highly developed park. These are to be connected with the extensive Marine Park at City Point, South Boston, which has a great bath-house, with a pier and a bridge connecting with Fort Independence in the harbor. One may drive from town over his entire system, or take electric cars on Washington street for Franklin Park or for Marine Park. In addition to this there are bath-houses at North End Beach on Commercial street, close by the historic ground of Copp's Hill; and playgrounds at Wood Island Park, East Boston, and at Charlestown, and various other sections of the city. The most accessible is Charlesbank, on the Charles River between the bridges to Cambridge, which contains open-air gymasia for men and boys and for women and girls. In Cambridge practically all the shore of the Charles river has been acquired, and is gradually being turned into an esplanade and river park. Playgrounds have also been laid out and carefully developed at Cambridge Field and several other places about the city. Cambridge Common, close by Harvard College and Christ Church, was the ground where troops camped in the Revolution, and under the elm close by on the west Washington took command of the army.

The Metropolitan Park System comprises a series of notable reservations of wooded wild lands, of sea-shore and river-bank, and of connecting parkways. Of the

wooded wild lands the Blue Hills is largest, and may be seen as the sky line to the south seven miles long from Quincy, by the seacoast, on the east to the Great Blue Hill, 635 feet high, on the west. Within this reservation are at least 20 other hills of somewhat lesser height. It is ten miles from the State House, and contains over 4,200 acres. It is most conveniently reached by carriage or on foot from Readville, on the Providence Division of the New York, New Haven, & Hartford R.R. The Middlesex Fells of 3,200 acres is nearer and more diversified. Its southernmost point is Pine Hill (252 feet high), in Medford, within five miles of the State House. It contains over 600 acres of water in ponds, most of which are used in connection with the water supply of the district. It has an abundance of good roads, and from its higher hills, and especially from Bear Hill (375 feet high), a grand view of the sea and of the country, even to the hills of southern New Hampshire, may be had. Good examples of the roads or parkways of the Metropolitan System thus far built may be seen near by in the Mystic Valley Driveway, along Mystic Lake, and in Fellsway, running from the reservation to a point within three miles of the State House. This reservation may be reached most conveniently by carriage or 15 minutes' walk from Medford (branch of Boston & Maine R.R.), or West Medford or Winchester (southern division of Boston & Maine R.R.), or from Malden or Melrose (western division of Boston & Maine R.R.). Of the smaller woods reservations Beaver Brook Oaks at Waverly (Fitchburg R.R.) contains the most notable oak-trees in this part of the country. The largest has a spread of limbs of 48 feet, and girth of trunk

of 18 feet at four feet above base. Stony Brook is a pretty tract of 460 acres of woodland, forming part of a parkway to connect the Boston Park System with the Great Blue Hill. The banks of the Charles River not previously controlled for public or quasi-public uses have been acquired as a metropolitan reservation as far as Newton Upper Falls, at which point Hemlock Gorge is a most notable bit of scenery, made up of fine hemlocks, a great bridge of the Boston Water System, and the river rushing over a dam in a rocky gorge. The view in general may best be seen by launch, boat, or canoe, which may be procured at Waltham (Fitchburg R.R.) or Riverside (Albany R.R.). Revere Beach is the most notable public beach in the world. Two years ago there was a railway on its crest and houses crowded to the water's edge. To-day it stands out in its natural form, free of all buildings except those back of a perfect road following the beautiful curve of the beach. Outlooks and shelters are provided, and a bath-house of 1,000 rooms, a model of beauty in design and arrangement. This beach is five miles from Boston, and is reached by the Revere Beach & Lynn R.R. (Atlantic avenue, foot of Franklin street), or by electric cars from Scollay square.

METROPOLITAN WATER WORKS.

To visit the various places of interest connected with the works requires more than one day, unless an early start is made. South Framingham, on the Boston & Albany Railroad, is the focal point for a visit to the storage reservoirs. It is reached in thirty-five minutes from Boston. A morning express train now leaves Boston at 8.30. The 10.00 A.M. train can be taken to Southborough or Fayville, and a carriage engaged to meet the visitor at either of these stations. From South Framingham it is an hour's drive by way of Framingham reservoirs No. 2, No. 1, and No. 3 to Sudbury dam in Fayville, and thence it is an hour's drive by way of Fayville across the Boston & Albany Railroad to Hopkinton reservoir and Ashland reservoir. A visit can be made to both and return made to Boston by afternoon train from Ashland or from South Framingham.

Chestnut Hill reservoir can be reached by electric cars marked "Reservoir," running through Boylston street to Beacon street.

Echo bridge, at Newton Upper Falls, on the Sudbury aqueduct, can be reached by the Boston & Albany Railroad, or by "Newton Boulevard" electric cars, either from Boston or from the Chestnut Hill reservoir.

THE Metropolitan Water District comprises the following cities and towns: Boston, Chelsea, Everett, Malden, Medford, Newton, Somerville, Quincy, Belmont, Hyde Park, Melrose, Revere, Stoneham, Watertown, and Winthrop, with a present population estimated at 760,000. All of the above are now supplied by the Metropolitan Water Board, excepting Newton, Belmont, Hyde Park, Watertown, Stoneham, and Quincy.

The plan of the metropolitan works embraces the taking at a point in the town of Clinton of the waters

of the south branch of the Nashua River, which drains a very large and thinly settled watershed in the northern central part of the State. These waters have already been combined with the supply already obtained by the city of Boston from the Sudbury and Cochituate systems.

At the point of diversion on the Nashua River a masonry dam is to be built to create a great reservoir to be known as the Wachusett reservoir. The dam has not yet been begun. A temporary dam has, however, been built across the river a short distance above the site of the permanent dam, turning the water into an aqueduct which has been built from Clinton to Southborough. The water now passes through this aqueduct to Sudbury reservoir in Southborough, and thence through existing reservoirs and works to Chestnut Hill reservoir in Boston. From Chestnut Hill reservoir the larger portion of the water now flows by gravity to the lower portions of the city of Boston. The remainder is pumped to supply the higher portions of Boston and the other cities and towns in the metropolitan district.

When the works are completed, all of the water will be pumped at Chestnut Hill reservoir for the purpose of increasing the water pressure in the lower parts of Boston. In order to distribute the water from Chestnut Hill reservoir to the several cities and towns, large main pipes have been laid. The low-service pipes extend northward to Spot Pond, which will be used as the main distributing reservoir for the low-service system. The existing pumping-station at Chestnut Hill reservoir, with an additional pump, now building, will provide water for the higher lands in the southerly part of the metropolitan water district, and the new pumping-station at Spot Pond will supply the higher lands in the north-

erly part of the district. The metropolitan works supply water to the main pipes or reservoirs of the cities and towns in the Metropolitan Water District, but have nothing to do with the local distribution of water.

STATISTICS.

Total areas of water-sheds	212.3 sq. miles.
Daily capacity of sources in driest year, including Sud- bury and Wachusett reser- voirs	173,000,000 gallons.

Proposed Wachusett dam :

Height above surface of rock	184 feet.
Height above bed of river	129 “
Length	1,250 “

Proposed Wachusett reservoir :

Contents	63,068,000,000 gallons.
Length	8.41 miles.
Maximum depth	129 feet.
Average depth	46 “
Water surface	6.56 sq. miles.

Wachusett aqueduct already built :

Length	12 miles.
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Sudbury reservoir and dam :

Length of dam	1,865 feet.
Water surface of reservoir	2 sq. miles.
Contents	7,500,000,000 gallons.
Maximum depth	65 feet.
Average depth	19 “

The amount of water now on store (June, 1898) in the system is about seventeen thousand million gallons (17,000,000,000).

The water flows by an open waterway from Sudbury dam to Framingham reservoir No. 3. It then flows through two 48-inch pipes to the Sudbury aqueduct, which extends from Framingham to Chestnut Hill reservoir. A new aqueduct will be required in the near future extending from Sudbury reservoir to a point in Weston a short distance west of the Charles River, with a total length of 13.26 miles. This aqueduct at its terminus will be about 60 feet higher than Chestnut Hill reservoir, so that it will furnish a supply by gravity through pipes to the lower part of the metropolitan district.

DISTRIBUTION SYSTEM. — An addition to the Chestnut Hill pumping-station is building, and a new pumping-engine is in course of erection, with a capacity of 30,000,000 gallons. The present pumping-station contains a high-service Leavitt pump of 25,000,000 gallons capacity, and two Gaskill pumps of 8,000,000 gallons capacity each. A new pumping-station is to be erected easterly of the present station, designed for the low service, and three engines, each with a capacity of 35,000,000 gallons, have been contracted for.

Two lines of 48-inch pipes are required to be laid from Chestnut Hill reservoir to supply water to the communities north of Charles River and to Spot Pond; the latter will be used as the main distributing reservoir for the low-service system. This pond is 20 feet higher than Chestnut Hill reservoir, and the water is pumped into it by the existing pumps, which are used temporarily for that purpose. About forty-three miles of distributing mains, from 48 to 36 inches, have been laid, and about ten miles more of pipe will be required.

The Metropolitan Water Works are under the charge

of the Metropolitan Water Board, Hon. Henry H. Sprague, Chairman, and Mr. Frederic P. Stearns is Chief Engineer. Detailed information may be procured from Mr. Desmond FitzGerald, Department Engineer, 3 Mt. Vernon street, by parties desiring to visit the works.

METROPOLITAN SEWERAGE.

THE sewerage of Boston and twenty-six cities and towns in its immediate vicinity is effected by four principal systems of sewers, all the sewage being finally discharged into the waters of Boston Harbor at two points, Moon Head and Deer Island, the former on the south and the latter on the north side of the harbor. The oldest system is that known as the Boston Main Drainage Works, discharging at Moon Head. This was built and is operated by the city of Boston, but in order to prevent the pollution of rivers in the metropolitan district it soon afterwards became necessary to invoke the aid of the Commonwealth, and other systems — one wholly independent of the Boston Main Drainage Works and two connecting with them only for disposal purposes, but all three built and operated by the State — have since been added.

It will be convenient to describe separately the systems built by the city and the State, giving to the former its usual name of “The Boston Main Drainage Works,” and to the latter, collectively, the name by which they are usually known, viz. : “The Metropolitan Sewers.”

THE BOSTON MAIN DRAINAGE WORKS.

These works take the sewage from the greater part of the city of Boston and also the sewage of six other cities and towns.

Their principal features are :

A system of intercepting sewers, generally below the level of low tide, along the margins of the city, to receive the dry-weather flow and a portion of the storm-water from the common sewers; a system of regulators and overflows in connection with the main and intercepting sewers; the main sewer, into which the intercepting sewers empty, leading to a screening chamber near the pumping-station; the pumping-station, where the sewage is lifted about thirty-five feet through force mains to the deposit sewer, in which heavy matters deposit before reaching the tunnel under Dorchester Bay; the high-level sewer, leading from the tunnel to the reservoir at Moon Head, in which the sewage is stored during the latter half of the ebb and the whole of the flood tide; the low-level sewers, through which the sewage is discharged from the reservoir into the sea soon after the beginning of the ebb tide.

The screens or cages for intercepting coarse matters before they reach the pumps, and the machinery for hoisting the cages, are located in a small stone building a short distance above the pumping-station. The material intercepted is dried by pressing and burned under the boilers.

This station contains two high-duty compound pumping-engines, having a nominal capacity of 25,000,000 gallons per day each and a much greater actual capacity. It also contains two low-duty engines of the same nominal capacity for use when the sewage is increased by rain. Provision has been made for extending the pumping-station when necessary, and plans are nearly completed for a 75,000,000 gallons high-duty pumping-engine.

Each of these large twin sewers has a dam at its

lower end by which the sewage is kept at a sufficiently high level to insure a sluggish current which will permit the heavier matter, such as sand, coal, ashes, water-logged matches, bits of paper, small sticks, and rags, to deposit.

The only feature of the apparatus for removing deposits which can readily be seen is the wooden "sludge tank" on the edge of the channel. The deposits in the sewers are first moved to a point nearly opposite the tank by a movable scraping and flushing machine operated by the current; then are fed to a pipe leading to the tank by machinery operated by a small engine; and are conveyed to the tank by a strong current of sewage, there to be again deposited.

The sewage, after passing through the tank, flows back into the sewers below the dams already referred to at their ends. The deposits are emptied from the tank into scows and towed out to sea.

DORCHESTER-BAY TUNNEL.

Total length	7,160 feet.
Inside diameter of brick-work	7½ "

HIGH-LEVEL SEWER FROM TUNNEL TO RESERVOIR.

Length	5,900 feet.
Inside dimensions of sewer, 11 ft. high and 12 ft. wide.	

The discharge of the sewage from the reservoirs usually occupies about forty minutes, and, including the time occupied by cleaning the reservoirs, more or less sewage is entering the harbor for an hour and a half or two hours during the first half of each ebb tide,

and during the remainder of the time is stored in the reservoirs.

Area of reservoir	5 acres.
Capacity of reservoir	25,000,000 gallons.
An extension of the reservoir is now	
being made which will increase	
the total storage to	50,000,000 “

The sewage, being lighter than the salt water into which it is discharged, rises to the surface, and at the end of half an hour after the discharge is begun covers an area a half mile in diameter, which can be plainly seen by its color and because it contains enough grease to still the waves. At the end of another hour it has been so far diluted that no trace of it can be seen; and chemical analyses show that the water which has received the sewage, when it reaches a point two miles down-stream from the outlet, contains but little more polluting matter than the water not affected by this sewage, and less polluting matter than the water in the harbor near the city. After having reached this degree of dilution the currents continue to flow outward with increasing force for about three hours. The sewage has not fouled the beaches along its course except, to a small extent, close to the outlet in a cove which is sheltered from the current by the embankment covering the discharge sewers. The original design of the works included the construction of a sea-wall to shut off this cove, as it was anticipated that an eddy would be formed at this point and cause some fouling of the beach. This sea-wall is now under construction, and will probably be completed this season.

THE METROPOLITAN SEWERS.

The metropolitan sewers have been built by the Commonwealth to convey to the sea the sewage of districts from which it would otherwise be discharged into rivers and become offensive. These sewers traverse numerous different municipalities, and there is no authority except that of the Commonwealth sufficiently general to embrace the entire region. The cost of these sewers is apportioned by law among the communities whose sewage they convey.

The works comprise three distinct systems of intercepting sewers:

THE NORTH METROPOLITAN SYSTEM includes about 46 miles of main sewers, which form the outlet for the sewage of sixteen municipalities, including Winthrop, Chelsea, East Boston, Cambridge, Somerville, Malden, and other cities and towns in or near the valley of the Mystic River, with a population of about 387,000. Its most distant point is about 18 miles from the outlet at Deer Island. In this system are four pumping-stations and eight inverted siphons at the crossings of streams, five of which streams are tidal. THE CHARLES-RIVER SYSTEM, along the southern bank of that river, is about eight miles long, provides an outlet for the sewage of six municipalities, with a population of about 107,000, and connects with the Boston Sewerage System, which discharges into Boston Harbor at Moon Island. THE NEPONSET-RIVER SYSTEM, about ten miles long, provides an outlet for the sewage of five municipalities, with a population of about 50,000. This also connects with the Boston Sewerage System.

The metropolitan sewers (not including any local or town sewers) had cost to Sept. 30, 1897, the date of the last statement, \$6,430,000. An important addition now contemplated is a high-level sewer to convey by gravity the sewage from the high lands in the valleys of the Charles and Neponset Rivers to an independent outfall in Boston Harbor.

The North Metropolitan System is the most important from an engineering point of view. The main sewer begins at Stoneham, 15 inches in diameter and 47 feet above mean low water, steadily increasing in size to the pumping-station at East Boston, where it is about nine feet in diameter. On the way it receives the sewage from the lateral valleys, some of which has to be pumped at North Somerville and Charlestown to the level of the main sewer. At the East Boston pumping-station the sewage is raised about 15 feet to a sewer nine feet in diameter, leading to the pumping-station at Deer Island, where it is again raised and is discharged into the sea at an outlet about 1,800 feet from the southerly end of the island.

One of the most interesting of the siphons on the North Metropolitan System is at Shirley Gut, where some unusual methods of construction were adopted. This siphon is about 264 feet long. It consists of a shell of riveted tank steel, which is lined with three rings of brickwork. The siphon was constructed on shore in four pieces. The ends of each piece were closed by bulkheads. The piece, consisting of the steel shell, the brick lining, the bulkheads, and outer timbering, was then moved on rollers into the water and floated to its position over the trench previously dredged. Water was introduced and the piece was sunk to its proper place and joined to the work already

in position. The tidal current at Shirley Gut is swift, and it was necessary to close the Gut temporarily by a bulkhead of sheet piling. This siphon forms a depression of about 22 feet in the axis of the sewer. The interior diameter of the siphon is six feet two inches. The sewer leading from this siphon to the pumping-station on Deer Island is about nine feet one inch in diameter.

At this pumping-station the sewage is raised an average height of 11 feet to the outfall sewer which conveys it to the sea, into which it flows continuously.

The outfall sewer was constructed by excavating within a coffer-dam for a distance of about 700 feet from the shore. Beyond this distance it was constructed by a process somewhat similar to that used for the Shirley Gut siphon. The sections (each about 52 feet long), instead of being made on the beach and moved down on rollers, were made in strong cradles suspended from the side of the wharf, which cradles, with their contained pipes, were lowered when necessary by powerful screws and connecting machinery. Each section of pipe weighed about 200,000 pounds. A bulkhead was built in each end, braces were placed inside, and the section was then ready to be lowered into the sea. As already stated, the cradle could be lowered by the machinery referred to into the water and the section of pipe could then be floated out and towed to the outfall. The section was lowered into place at the outfall after being partially filled with water. The sections were connected with bolts and were covered with gravel. The pipes and junctions were found when entered to be perfectly water-tight.

The pumps at each of the pumping-stations are of

the centrifugal type. Those at Deer Island and East Boston have each a capacity of raising 45,000,000 gallons per 24 hours to a height of about 19 feet. Those at Charlestown have about half that capacity. There are two pumping-engines at each station, and a third is to be installed soon.

The work of construction on the metropolitan sewers was begun in May, 1890. The Charles River Valley System was put into operation early in the spring of 1892, having been completed during the preceding winter. Pumps in the stations on the North Metropolitan System were started as follows: East Boston, Feb. 13, 1895; Deer Island, March 5, 1895; Charlestown, July 29, 1895. Practically all the difficult and important work on this system had been completed some months prior to these dates. Some additions were made to it later. The Neponset Valley System was begun April 6, 1896, and was substantially completed in 1897. The maintenance of these works includes the operation of the four pumping-stations, the care of 65 miles of intercepting sewers, siphons, and other structures, and engineering studies for extensions and care of works.

TRANSIT IN BOSTON.

THE city of Boston is peculiarly situated as regards transit. The business portion of the city is located on the original peninsula, which, until recently, was connected on the south side with the mainland by a narrow "neck" of land nearly coincident with a part of the present Washington street. By the fillings of the portion around this peninsula the area of the city proper has been enlarged from the original 783 acres in 1804 to over 1,800 acres. The large section known as the Back Bay, most of the South End, and considerable areas near the Union Stations and elsewhere consist entirely of "made" ground. On the west side of the original peninsula is Beacon Hill, occupied for residences, and including Boston Common. The business district occupies the east and north sides of the peninsula.

Owing to the limited area of the city proper, even at present a large proportion of the persons doing business in Boston live of necessity in the outlying districts or suburban towns. Thus, in 1890, the population of the city proper, comprising the original peninsula with its additions of made land, was 161,330, and the population of the other districts comprised within the present city was 287,147, making a total of 448,447; while included in the so-called metropolitan district, within a radius of 10 miles from the State House, the total population was 854,740. At present this population is about 1,000,000. The business section of the peninsula above de-

scribed is the business centre for this population, and, more remotely, for the whole State. Into the city from all directions the tide of travel streams in the morning, to return at night.

Within a radius of three-quarters of a mile are the terminal stations of the six steam railroads entering the city, which bring in and carry out over 100,000 passengers daily; but an even greater number are carried by the numerous electric-car lines of the Boston Elevated Railway Company and the Lynn and Boston Railway Company, which are the only companies running street cars in the city.

This tide of travel is obstructed on the west by the Common and by Beacon Hill, so that no car lines run westward between Boylston street and Cambridge street. Moreover, the streets in the business portion of Boston are narrow and crooked and the sidewalks are notoriously insufficient. As a result of these conditions there is in the very centre of the city proper what is known as the "congested district." All the street-car lines aim to pass in a north or south direction through or into this district, which at one place is only 700 feet in width.

It is to be noted that the traffic is a traffic which tends to or from a common centre, and not a traffic in parallel lines; also that many of the car lines entering the congested district do not pass through it, but are looped or turned back at some point within it.

The limit of capacity of the streets and car lines in Boston was reached several years ago, and after years of agitation, and the consideration of many plans, the building of a subway, which is now nearly completed, was authorized. The commission to which the work

was entrusted was not required to build a subway, but was authorized to do so if deemed expedient. The subway plan was adopted, because street widenings would not only have been much more expensive, but would not have secured rapid transit for the surface cars, owing to the interference of other traffic and danger to the public, especially at the numerous street crossings. The plan of building an elevated railway through the centre of the city was also barred, on account of the narrowness of the streets and the great damage which would result to the abutting estates.

There are two southern entrances to the subway: one in the Public Garden near Boylston street, and one in the triangle formed by Tremont street, Shawmut avenue, and Pleasant street. Each of these entrances accommodates two tracks. These tracks come together at Boylston street, between which point and Park street there are four tracks. At Park street the two interior tracks form a loop, while the outer tracks are carried through the city under Tremont street to the north. These outer tracks are also connected by means of a loop, so that cars may either return from that point or continue through the city.

On the north side four tracks enter the subway near the Union Station, and the arrangement at Park street is practically duplicated at Scollay square.

Provision is thus made for carrying a large number of people to and from the centre of the city, both on the north and on the south, and for carrying a smaller number completely through the city.

Beyond the limits of the subway the two outer tracks are soon to be connected with the elevated structure, which will be continued on the south to Dudley street,

in the district known as Roxbury, and on the north to Sullivan square in Charlestown.

The principal features of the subway are as follows:

Its total length from either of the southern entrances to the northern entrance is about a mile and a half.

The number of miles of track is five and three-tenths.

The height, from the top of the rail to the roof, is fourteen feet.

The standard width of the two-track portion is twenty-four feet; of the four-track portion, forty-eight feet.

The roof is formed either by a brick arch or by horizontal steel beams with small brick arches between them.

The walls are either entirely of concrete or with vertical steel beams imbedded in concrete.

Electricity alone is used as a motive power and for lighting.

The Boston subway is the largest subway in the world in cross-section, and the only one containing four tracks.

It is the only subway adequately lighted throughout by electricity.

There are no grade crossings. Such crossings are avoided by means of interior loops, above referred to, and at junction points by means of sub-subways, as at the corner of Boylston and Tremont streets and near the Pleasant-street entrance.

The platforms are island platforms; that is, they have a track on either side. In Scollay square there is a triangular platform, which has a track on three sides. These platforms have great capacity for traffic. It is estimated that the two island platforms at Park

street will, when the subway is in full operation, accommodate a traffic greater than the present traffic of the steam railroads entering the city either on the north or on the south.

The estimated cost of the subway before the work was undertaken was \$5,000,000, including land. This estimate will not be exceeded.

Construction was begun in the Public Garden, March 28, 1895.

The subway has been built by the city of Boston and is its property.

It has been leased by the commission which constructed it to the West End Street Railway Company for a term of twenty years, at an annual rental of four and seven-eighths per cent. of the actual net cost, whatever that may be, provided it does not exceed the sum of \$7,000,000.

The property and franchises of the West End Street Railway Company, including its rights under the lease, have been assigned to and are now held by the Boston Elevated Railway Company.

Hon. George G. Crocker is Chairman of the Transit Commission. Mr. Howard A. Carson is its Chief Engineer.

GEOLOGY AND GEOGRAPHY OF THE BOSTON DISTRICT.

THE resistant crystalline rocks of the uplands of New England include belts and basins of weaker rocks, generally stratified, which have been worn down to valleys and lowlands. The low ground thus determined has been from the beginning of New England history much more attractive to settlement than the rugged uplands. The basin occupied by Boston and its suburban communities holds a large part of the population of Massachusetts within its hilly rim. To-day, when the higher uplands of the Commonwealth are decreasing in population, their loss is more than counterbalanced by the growth of the villages and cities in the valleys.

The uplands reach altitudes of a thousand or fifteen hundred feet in the interior, and there the valleys are strongly incised. A belt of relatively weak sandstones — easily worked in ornamental architecture, but poorly adapted to withstand the weathering of the ages — determines the Connecticut Valley, which lies from five to eight hundred feet lower than the hill country that encloses it. Near the coast the moderate altitude of the uplands does not place them in so strong a contrast with the lowlands; the difference of elevation between the lowlands of the Boston basin and their enclosing hills is only from one to three hundred feet. A slight depression of the land has allowed the sea to encroach

upon its borders; thus a part of the basin is drowned in the reëntrant of Boston Harbor, while the uplands advance to the rocky shores of Lynn, Salem, and Gloucester on the north and of Nantasket and Cohasset on the south. The reëntrant would reach still farther inland if it were not for the heavy deposits of drift by which the floor of the basin is somewhat raised in level; but even so, a great advantage came to Boston from its better connection with the interior, especially since the days of railroads; and chiefly on account of this advantage it has outstripped its early rivals on the New England coast.

The uplands that enclose the basin may be well seen at Arlington Heights on the north or from Blue Hills on the south; the latter rising to a distinctly greater height than their neighbors and commanding an extensive view. All the uplands consist of igneous or metamorphic rocks of involved structure. They are as a rule of deep-seated origin, the formerly overlying masses having been removed by long-continued denudation. The intricate structural relations produced by successive intrusions and eruptions of granites, melaphyres, and felsites are well exhibited on the wave-swept shore of Marblehead Neck and thence southward for half a mile. The extensive quarries of Quincy are worked in a massive intrusion of granite.

The lowlands of the basin are by no means level; indeed, their coarse conglomerates form strong hills in Roxbury and Dorchester, and their amygdaloidal melaphyres rise in ridges through Brighton and Newton. The lower ground is for the most part underlaid by slates, which occasionally rise through the drift cover, as in Somerville and Wollaston; in Braintree a small slate

quarry has long been famous for affording fossils of an ancient trilobite, *Paradoxides Harlani*. Igneous dikes cutting the slates and conglomerates are often seen in quarries and railroad cuts.

The general observer will be less impressed by the bed rocks, which in spite of their variety are exposed on but a small part of the surface, than by the overlying drift, whose different forms are the chief determinants of the local landscape in much of the Boston district. Where ledges are freshly uncovered they suggest glacial action by their smoothed and striated surface, and by the immediate change from firm unweathered rock to the overlying discrete or unconsolidated materials; thus presenting a strong contrast to the blending of rock and soil that prevails south of the limits of glaciation. Where the drift is comparatively thin, it veneers the rock floor, preserving its form, as is frequently the case on the uplands; but the drift has generally assumed a shape of its own, unlike that of the under rocks.

The most striking features of the drift are the long elliptical hills, known as drumlins, that rise with arched crests to heights of one or two hundred feet above their base. Corey's Hill, and many others in Brookline and the Newtons, are of this nature. Beacon Hill, bearing the State House, in Boston and Bunker and Breed's Hills in Charlestown are drumlins. Many islands in the harbor are of the same origin. All these hills consist of unstratified drift or till, compact but not consolidated, a conglomeration of coarse and fine materials, partly of local origin, partly derived from the rocks that outcrop to the northwest of their site. Their longer axes trend to the southeast, closely parallel to one another and to

the direction of the latest striations on the neighboring ledges. Hence it cannot be doubted that the drumlins received their form as well as their substance and structure directly from the action of the creeping ice sheet. They are best explained as comparable to sand bars in rivers: the result of gradual accumulation in a form of least resistance at such places as received more drift than could be dragged farther forward. Their slopes are still so little washed and gullied that the duration of post-glacial time must be short. Drumlins similar to those of the Boston district are strewn over many parts of the New England uplands. They are generally cleared and farmed: fields marked off by stone walls lap smoothly over their rounded profiles; thus they are readily distinguished from the more rugged, wooded ridges.

The till, either in veneers or in drumlins, was formed when the margin of the ice sheet lay some distance to the south, near its outer terminal moraines. During the disappearance of the ice its retreating margin withdrew northward across New England. Where it halted for a time moraines of retreat were formed, but these are few and discontinuous; even where best developed, as at Dogtown Commons, near Gloucester, they are weak compared to the terminal moraines that form considerable belts of rolling hills and hollows farther south; the hills of Manomet, just beyond Plymouth, being the nearest large accumulations of this kind.

A common variety of drift deposit formed during the retreat of the ice is seen in the gravel hills of various forms, generally occupying valleys and lowlands, where the drainage of the melting ice sheet ran away. Irregular gravel hills, thirty to fifty feet high, built of well-

stratified gravels and sands, and known as kames, are plentiful at Auburndale and about Newton Lower Falls, where they have been extensively excavated to provide material for filling in the Back Bay of Boston, now built over by its finest dwellings. Serpentine ridges of washed and roughly stratified gravels, known as eskers, are interpreted as the fillings of subglacial tunnels, along which active streams ran forward under a strong head of pressure from higher ground still occupied by the ice sheet on the north. A remarkably fine esker may be seen in Auburndale; it is cut across by the circuit line of the Boston & Albany Railroad between Riverside and Woodland stations. A walk of half a mile along the narrow crest of the ridge, gently rising and falling, turning gracefully to the right and left, will give a good view of this curious little geographical element. Another excellent esker is found between Newtonville and Newton Centre, and this one is of particular interest, inasmuch as it leads forward into a well-formed sand plain or delta of fine, stratified sands, capped with gravels. This deposit evidently marks the site of a temporary ice-dammed lake, at a height of about a hundred feet above present sea level, into which an active but short-lived stream ran from the retreating ice sheet. The contrast between the northern margin of the delta, where it bordered on the ice sheet, and the free southern margin, where it grew forward about a quarter of a mile into standing water, is very clearly seen. The electric cars of the Newton Boulevard line cross the delta at its middle, and at present pass by a fine section of sands and gravels on its western side.

Ponds are often found in close association with plains of sands and gravels, so that it has come to be believed

that the pond basins represent spaces that were occupied by more or less isolated and lingering masses of ice, while the sands were washed into the evacuated space about them. Spy Pond in Arlington, Walden Pond in Concord, and many others in or near the Boston basin, might be mentioned as excellent examples of this kind.

The lower grounds of the basin are often occupied with bedded clays, extensively pitted for brick-making in North Cambridge. The clays contain occasional striated stones and bowlders, supposed to have been ice-rafted into the water body — probably an expansion of Boston Harbor during a lower stand of the land — in which the clays were deposited. A post-glacial age has generally been assigned to these clays, but recent observations show that in some cases they underlie the till, and hence in such cases at least they must be regarded as of earlier date than the last glacial epoch. Near the coast line there are extensive salt marshes at high-tide level, intersected by irregular tidal channels. The largest of these near Boston is seen on the way to Lynn. The marshes yield a crop of salt hay, which when harvested and stacked on low stilts give a bit of characteristic local landscape.

The phenomena of the shore line are exhibited in great variety in the neighborhood of Boston. The waves fume and fret on the slopes of the rocky uplands; here the shore is ragged, sufficient time not having elapsed since the waves worked at the present level to accomplish much work in cutting back the shore line into cliffs based by beaches. The peninsulas of Nahant and Marblehead Neck, and the greater part of the "North Shore" from Salem to Gloucester, is of this kind. Pocket beaches swing in smooth concave

curves around little coves between the ragged headlands; here the waves break in even rollers.

Cliffs and beaches are extensively developed on the drumlins of Boston Harbor. Many drumlins have been reduced to less than half their original size; the bold cliffs by which they are now terminated on the ocean side giving excellent sections of their structure. The beaches at the base of the cliffs are often extended beyond the island from which their material is supplied, and a number of islands have in this way been united to the mainland. In other cases the growth of tidal marshes back of the beaches has aided in converting sea into land. An afternoon trip by steamboat to Pemberton Landing, by train to Nantasket, and back by boat, gives fine illustration of many of these features. If a stop be made from the train at Point Allerton a cliffed drumlin may be ascended and a fine view gained far out to sea and inward across the harbor.

PLACES OF HISTORICAL INTEREST.

OF the historic landmarks which give Boston a flavor of antiquity and a charm unique among American cities, the OLD STATE HOUSE, so called, is of the first importance from the wealth of its associations. As the seat of the royal governors and the Provincial Council, of the Legislature of the Province and the Commonwealth, of the higher courts, the place where "the child Independence was born," when James Otis, with a "tongue of flame," delivered his bold argument against Writs of Assistance in the presence of the big-wigged and scarlet-robed justices fourteen years before the outbreak of the Revolution, the Old State House is distinguished as the most interesting historical building in the United States. It has stood since 1747, and was built on the walls of its predecessor, the second Town House in Boston, which like the first one [1658-1711], on the same spot, was destroyed by fire. The exterior above the second story is now generally as it appeared in the Province period, while the interior above the same story shows essentially the original architecture, the structure having been rescued from vandal hands and these portions restored about sixteen years ago, when the upper floors passed to the custody of the Bostonian Society, a worthy Boston institution incorporated in 1881 "to promote the study of the history of the city" and "the preservation of its antiquities." This society maintains in the restored

apartments, or memorial halls, as they are termed, an exhibition of historical treasures which is open to the public without fee. In the Province period the second floor was divided into three chambers with lobbies — the Council Chamber at the east end, opening upon the balcony from which proclamations were heralded to the people; the Representatives' Chamber in the middle; and the Court Chamber at the west end. During the Revolution, when the General Court was enlarged, the Court Chamber was taken into the Representatives' Chamber, the courts having removed to the first separate courthouse built in 1768-69 on Queen now Court street. Of these halls the Council Chamber is preserved in its original form. A board is here inscribed with a concise history of this memorable apartment. Upon the formation of the State government it became the Senate Chamber, the Governor and Council of the Commonwealth being established in the old Province House, the stately official residence of the royal governors which stood back from the present Washington street, nearly opposite the head of Milk street. This building remained the State House till the completion of the capitol on Beacon Hill in 1798. When Boston was made a city it became the first City Hall. Originally the superstructure was supported by ten Doric pillars, and the street floor, as in the previous building, was a "walk for the merchants" — the first merchants' exchange. Then the main entrance was from the east front. A brief sketch of the building is published in pamphlet form by the Bostonian Society. Its history with that of its predecessors may be more fully traced in the "Old State House Memorial," entitled "Rededication of the Old State House" (6th edition, 1892), published by the city, and in

the late George H. Moore's pamphlet, "Prytaneum Bostoniense : Notes on the History of the Old State House, formerly known as the Town House in Boston ; the Court House in Boston ; the Province Court House, the State House, and the City Hall."

The neighborhood of the Old State House is historic ground. The building stands in the first market place of the settlement. Near it on the south side of the square, at about where the Brazer Building stands, was the first Puritan meeting-house. On the north side, about where Devonshire street continues, was the first minister's house and garden. Below the meeting-house, the site covered by the great Exchange Building, was Governor Winthrop's first house — a recent discovery, made by a delver among old deeds, who upsets the theory of previous authorities that Winthrop's only house was that which stood opposite the foot of School street by the "Governor's Green," and was burned by the British during the siege. Where the towering Ames Building stands was the home of Dunster, the first president of Harvard College. Where the Sears Building stands was Governor John Leverett's house. In the square in front of the Old State House, during the Stamp Act excitement, a stamped clearance was publicly burned. Here occurred the so-called "Boston Massacre" of 1770, the point where Preston's file of soldiers stood now marked by a circle in the paving near the Exchange-street corner.

THE OLD SOUTH MEETING-HOUSE, the "Sanctuary of Freedom," where were held the great popular meetings which "kindled the flame that fired the Revolution," and Faneuil Hall, the "Cradle of Liberty," rank close to the Old State House in historical importance. The

plain brick meeting-house, dating from 1739, is further distinguished by its situation on Governor Winthrop's "Green," occupying the site of the first South Meeting-house [1670-1739], for which the garden lot attached to the governor's house was given by Madam Norton, widow of the good John Norton, third minister of the First Church, into whose possession the estate had come. In the "steeple chamber" was Thomas Prince's "New England Library," precious papers from which were burned in the stove set up to warm the meeting-house when Burgoyne's troopers turned it into a "riding school" during the siege; and from which, perhaps, disappeared at the evacuation, "strayed or stolen," the Bradford manuscript "History of New Plimouth," discovered in later years in the library of the Bishop of London, and now, recovered, preserved in the State Library at the State House. The historic structure, with its inspiring memories, is a spared monument through the exertions of a number of patriotic Boston men and women, who, twenty-two years ago, in the "centennial year," moved successfully for its preservation when its demolition was imminent, the Old South Society having removed to the sumptuous modern church which it had built in the Back Bay quarter. A loan collection of relics occupies the interior. A small charge of admission is made, which is applied to the Preservation Fund. The auditorium is occasionally used for meetings to consider questions of public concern; and here are given the regular series of "Old South Lectures to Young People," an institution established by the late Mrs. Mary Hemenway, the fame and influence of which have become widespread. The events of Revolutionary interest here are sketched in a

pamphlet history of the meeting-house, published in 1876, for the benefit of the Preservation Fund. In the earlier South Church, a "little cedar meeting-house," Franklin was baptized; his birthplace was opposite the south side, on Milk street, the site now covered by the building numbered 15.

FANEUIL HALL as it now appears is the Faneuil Hall of the Revolutionary period widened, heightened, and embellished, under the direction of the pioneer Boston architect, Bulfinch, in 1805. At that time the third story was added, the hall was enlarged, the galleries resting on the Doric columns were put in, and the platform, with its extended part, was built. The portraits which adorn the walls are mostly copies, the originals being in the Museum of Fine Arts for safe-keeping. The large canvas back of the rostrum, by Healy, representing Webster delivering his reply to Hayne in the old Senate Chamber, is of peculiar interest from the fact that the faces in the audience are portraits of Senators and public men of that day. The historic building, which Otis, the orator of the occasion, dedicated to the "cause of liberty," and which the "service of the popular leaders to the country associated with the idea of civil freedom," dates from 1763, having been rebuilt by the town on the ruins of the first Faneuil Hall and Market House, Peter Faneuil's gift (erected in 1741-42), which was burned, all but the outer walls, two years before. It was from the first the regular place of town-meetings, the Old South being used when greater room was required. In the upper story is the armory of the Ancient and Honorable Artillery Company, the oldest military organization in the country, dating from 1638. The company has here a varied assortment of relics.

CHRIST CHURCH, at the North End, which bears on its face the tablet stating that Paul Revere's signal lanterns were displayed in its steeple the night before Lexington and Concord, is the oldest church building now standing in Boston, seven years older than the Old South. While its claim to distinction as Revere's signal tower is disputed by authorities on local history (whose contention is that the lanterns were shown on the "Old North" Church in the neighboring North square, which was torn down during the siege and used for fire-wood by the British soldiers), it is in itself interesting, having suffered comparatively little change through the century and three-quarters of its existence. Among the mural ornaments of the interior is Houdon's bust of Washington, which was placed here but ten years after Washington's death, the first monumental effigy of him to be set up in the country. The rarest of the old furnishings are retained, and its choice possessions include pieces of a silver communion service, bearing the royal arms, given by George II. in 1733, a massive christening basin, which has been in use since 1730, and various other ancient things. In the tower is a chime of eight bells, hung in 1744, "the first ring of bells cast for the British Empire in North America," as one of them is inscribed. The steeple is a copy, said to be exact, of the original one, which fell in a gale in 1804. It was erected in 1807 from a model by Bulfinch. The church is open to visitors daily, and the sexton serves as guide, for a fee of 25 cents. It is fully described and its history outlined in the Rev. Edward G. Porter's "Rambles in Old Boston, New England."

COPP'S HILL BURYING-GROUND, hard by Christ Church, embraces in its oldest part (on the northeast

side) the North Burial-ground, first used in 1659. The other portions were additions, or separate cemeteries laid out at later periods. All, now old, were united under one name some years ago. Its sightly situation, fine shade trees, and footpaths among the thick-clustered tablets of early date and often curious design, some with family coats-of-arms, render it one of the most attractive of the ancient burial places of the city. Here are the tombs of the Mathers — Increase, Cotton, and Samuel; of the father and grandfather of Thomas Hutchinson (their remains long since scattered by a vandal and another name cut in place of Hutchinson); of Nicholas Upsall, the martyr friend of the persecuted Quakers, whom Whittier depicts; Jesse Lee, the early preacher of Methodism; Edmund Hartt, the builder of "Old Ironsides," at his shipyard now marked by Constitution Wharf; and various others of note. One tablet is much dented with bullet-marks, it having been a favorite target with British soldiers at the time of the siege. The battery from which Charlestown was fired during the Battle of Bunker Hill was on the west side of the ground. A sketch of "Old Copp's Hill and Burial Ground," prepared by the superintendent of the place, gives considerable detail, while Whitmore's "Copp's Hill Book of Epitaphs" is an authority.

This quarter of the city — the "Old North End," the first "elegant part" of the town — is full of historical interest. Although beyond the old church, the old burying-ground, and a few old houses, no visible landmarks now remain, it is easy with the aid of local guide-books to trace its numerous historic sites. Of the old houses the most sought is that in which Paul Revere lived some years before and through the Revo-

lution. This is on North square. On Hanover street, just below North Bennet street, is a Colonial landmark in the remnant of the Mather-Eliot house, built in 1677 by Increase Mather, after the loss of his house in North square by the "great fire" of 1676. Here he lived till his death in 1723. After him the house was the home of the Eliots, Andrew and John, father and son, ministers respectively of the "New North Church" from 1742 to 1813.

The stone KING'S CHAPEL, doubly distinguished as the seat of the first Episcopal church in Boston and of the first Unitarian, is the most picturesque of the historic churches still retained. It was built slowly between 1749 and 1754, so constructed as to enclose the first King's Chapel, the plain little building of wood erected in 1688 during the governorship of the "arbitrary Andros." Governor Shirley laid the corner-stone. It occupies in part a corner of the old burying-ground which was taken for the first chapel, no Puritan landholders being found to sell, because "they would not set up that which the people came from England to avoid." The interior, with its rows of columns supporting the ceiling, illuminated windows in the chancel, antique pulpit and reading-desk, recalls eighteenth-century London churches of the school of Wren. Numerous memorials, mural tablets, and quaintly sculptured monuments enrich the walls. In the tombs beneath the chapel were buried Shirley, three major-generals who distinguished themselves in the conquest of Canada, and other Boston worthies.

KING'S CHAPEL BURYING-GROUND, adjoining, was the first burial-place in the town, dating with the settlement. Here are the tombs of Governors Winthrop and

Leverett; of the two Governors Winthrop of Connecticut; of John Winslow and his wife, Mary Chilton of the "Mayflower" passengers; John Cotton and three other ministers of the First Church; several of the early justices; Lady Andros, wife of Sir Edmund, the governor Isaac Addington, Major Thomas Savage, and others of distinction in Colonial days.

The GRANARY BURYING-GROUND, near by, was the third established — in 1660. At first called the "South Burial Ground," it early acquired its present name from its proximity to the town granary, which stood near the spot now occupied by the Park-street Church. Of the three ancient cemeteries this contains perhaps the largest number of distinguished graves. They include the tombs of seven governors, three signers of the Declaration of Independence, the parents of Benjamin Franklin, Judge Samuel Sewall, Peter Faneuil, Paul Revere, the victims of the "Boston Massacre." There are monuments to Franklin's parents and to John Hancock; and recently bowlders have been erected to the memory of Samuel Adams and James Otis. Bronze tablets inscribed with names and dates are on the gates of these old burying-grounds.

The historic part of the STATE HOUSE on Beacon Hill, with its gilded dome, which Bostonians now call the "Bulfinch Front" to distinguish it from the extension of modern build in the rear, dates from 1798, begun in 1795. It occupies John Hancock's pasture. It is a cherished piece of Bulfinch's work, of which little now remains in Boston where early in the century there was much. Within the past year the building has been restored, so far as could be, to its original fashion, and made fire-proof. Like other historic buildings in the

city it has been preserved through the persistent exertions of public-spirited citizens.

TRANQUIL BOSTON COMMON, in the heart of the city, has been public ground since 1640, when it was set apart for a "trayning field." For its spacious malls, its noble elms, its "Frog Pond," Boston is indebted to the fathers, while its protection from destruction is due to the foresight of the early settlers. Its rich history, with the record of happenings upon it, has not yet been adequately given. Shurtleff, perhaps, gives the most detailed sketch in his *Topographical and Historical Description*. The Common now embraces about forty-eight acres. The smaller Public Garden, below, is of modern make. It is built upon the edge of the Back Bay, which used to flow to the line of Charles street, and in place of which is the "elegant quarter" of the Boston of to-day.

BUNKER HILL MONUMENT (built 1825-1842, 220 feet high) is a short electric-car ride or easy walk from State street. In the old Phipps-street Burying-ground, not far from the Monument grounds, is the first monument erected to John Harvard by graduates of Harvard College, in 1828.

NOTE.—Famous places of historical interest beyond the limits of Boston are within easy reach of the city by electric car or frequent trains on the steam railroads. Those embraced in a radius of twelve miles from the State House are treated in Bacon's "Walks and Rides in the Country Round About Boston," a compact handbook with pocket maps, published by Houghton, Mifflin & Co. for the Appalachian Mountain Club. Excellent special guides to several of these and more distant historic towns may be found in Boston or local bookstores. For Cambridge, see Charles Knowles Bolton's "The Gossiping Guide to Harvard and Places of Interest in Cambridge." Much interesting information is also to be found in the larger publication, "The Cambridge of 1896," Arthur Gilman, editor. For Lexington, see "Lexington: a Handbook of its Points of Interest, Historical and Picturesque," published under the direction of the Lexington Historical Society. For Concord, "The

Concord Guide-Book," by the late George Bradford Bartlett. For Salem, "The Visitor's Guide to Salem," issued by the Essex Institute. For Marblehead, Samuel Roads, jr.'s, "Guide." Boston historic points are systematically covered in "Boston Illustrated: a Familiar Guide to Boston and Vicinity," with a dictionary index, by Edwin M. Bacon, published by Houghton, Mifflin & Co. See also titles of guide-books in "Preliminary Announcement" of the Local Committee.



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